

PUBLIC WORKS

May
1957

CITY, COUNTY AND STATE

*A complete text for
reference and instruction*

**The OPERATION of
WATER TREATMENT
PLANTS**
page 121

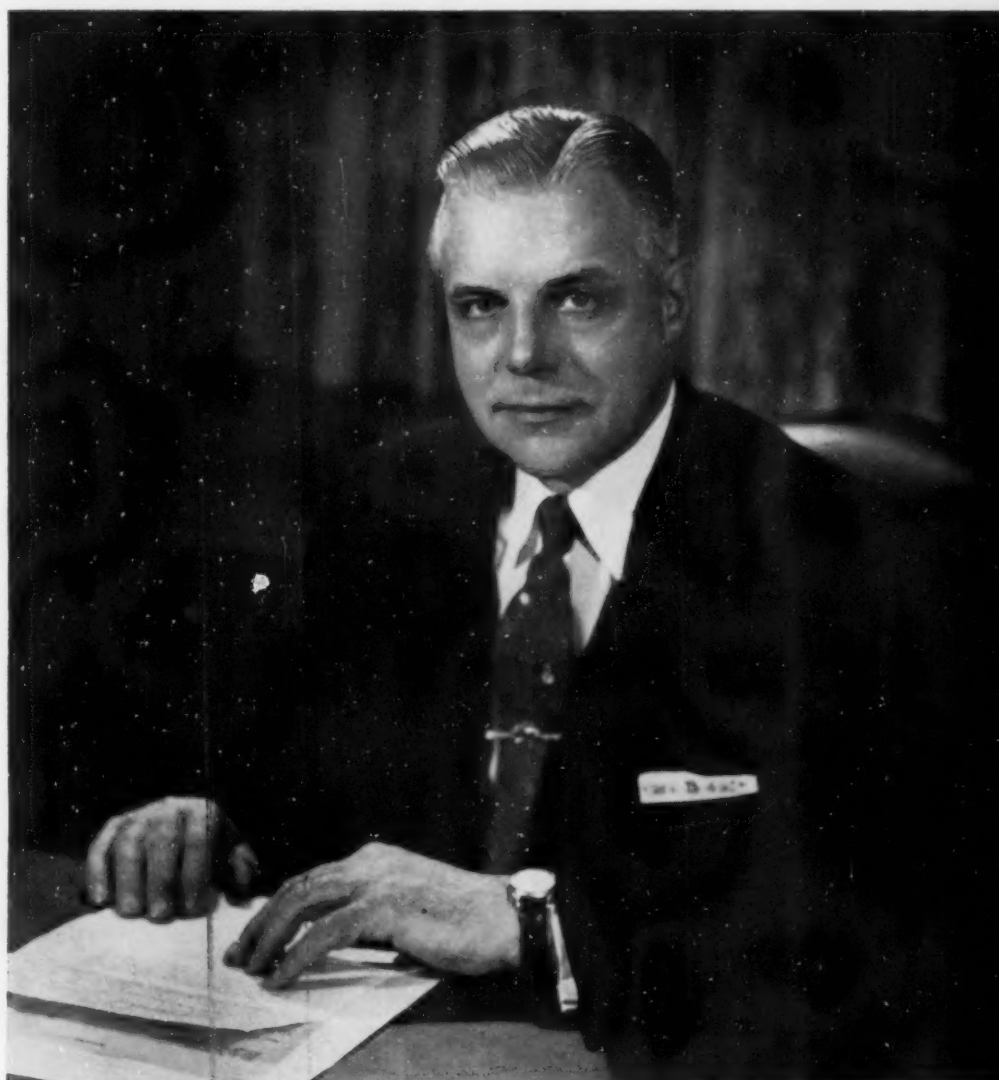
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Harry E. Schlenz, President of the Water and Sewage Works Mfrs. Ass'n., is also President of Pacific Flush Tank Company. He has been one of the leaders in developing sewage treatment processes. More on page 24.

*From
Sub-base
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Surface*

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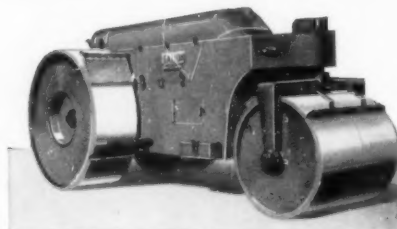
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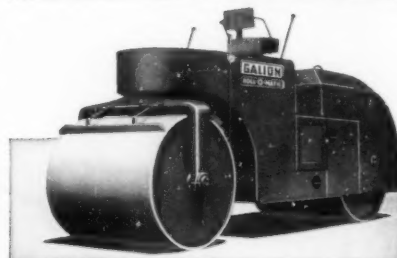


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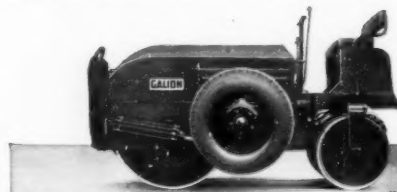


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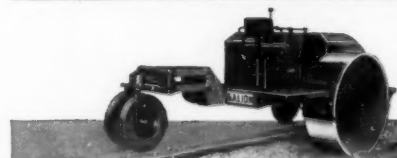
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PERSON

TITLE

FIRM

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CITY

STATE



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from

the
aeration
story



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WIDE BAND AERATION +
SWING DIFFUSERS =**
maximum oxygenation efficiency
for high treatment at low cost

Since their installation at the Lima, Ohio Sewage Treatment Plant shown above, Chicago Pump Company Swing Diffusers and Precision Tubes have operated for over a year with no problems whatsoever. Plant records show excellent results in high grade effluent for the aeration tanks with Chicago Pump Company equipment. From January through May, 1956 this plant handled an average of 8 M.G.D. using an average of 0.498 cubic feet of air per gallon of sewage.

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J. E. Cossiboin, Levee Board Inspector, New Orleans, La.



Mr. Cossiboin is talking about the Caterpillar No. 955 Traxcavator* owned by the Orleans Levee Board. He says: "Ours was the first No. 955 in this area and it went to work loading sand the day it came. The machine frees five men for other jobs. It loads a truck in three minutes where the job used to take 30. Also it eliminated the need for a dragline clamshell. It's the handiest machine I've ever come across."

The Levee Board finds plenty of work for its CAT* No. 955 Traxcavator. Shown here, the unit is cleaning up excess dirt after laying underground cables. In addition, it's used for 'dozing, grading, building levees, loading shell, sand and rip-rap.

Other cities have the same high opinion of the No. 955. This fast, efficient excavator-loader has a 1½-cu.-yd. bucket, 80 inches wide. A dependable 70 HP Cat Engine gives it ample digging power in tough materials. The 40-degree tilt-back of the bucket at ground level prevents spillage and adds to stability, and the 128-inch lift height makes for easy loading.

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Published Monthly by Public Works Journal Corporation, Office of Publication at Orange, Conn. Editorial and Advertising offices at 200 So. Broad St., Ridgewood, New Jersey. Subscription rates: U.S.A. and possessions, \$5.00. Canada and South America, \$6.00. All other countries, \$7.00. Accepted as controlled circulation publication at Orange, Conn.

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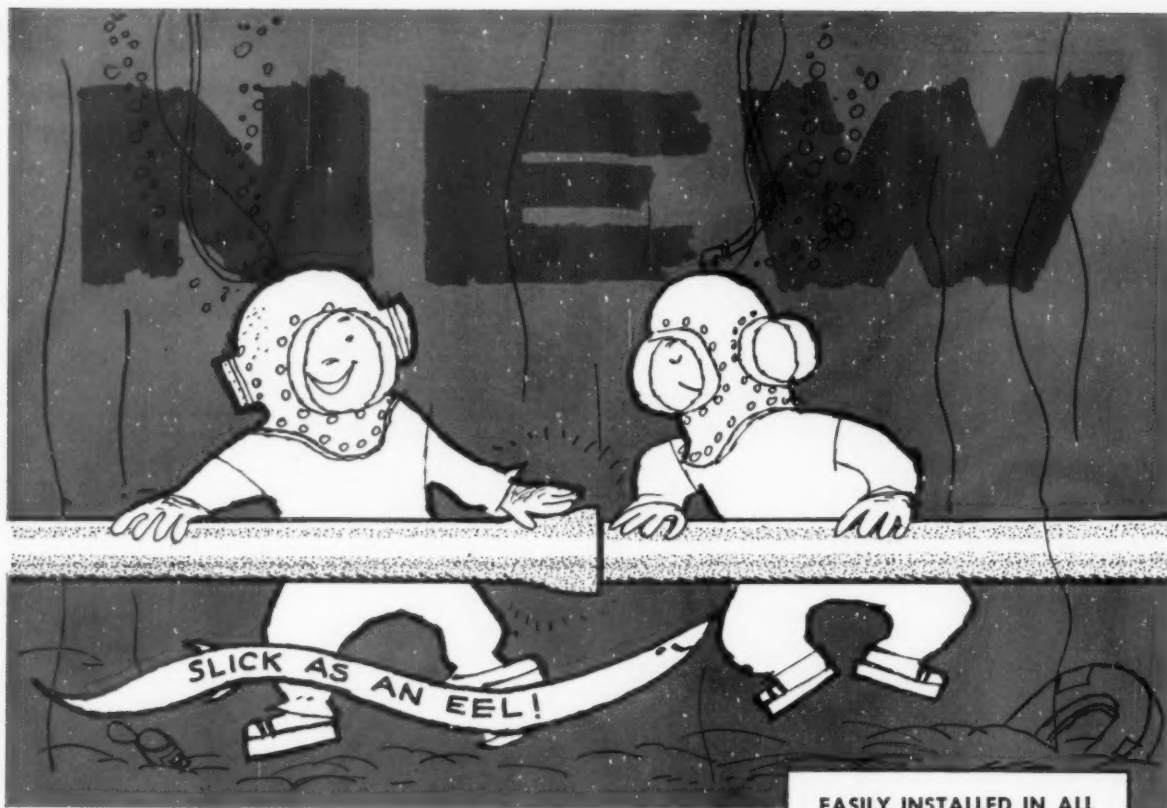
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THE MOST USEFUL ENGINEERING MAGAZINE FOR CITIES, COUNTIES AND STATES



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POINT OF VIEW

The Engineer Ought to Know As Much About His Job As Anyone Else Knows About His

WE HAVE always felt that the engineer of any organization, whether state, municipal or industrial, ought to know as much about his job as anyone else in the organization knows about his. In addition, he ought to have a good general knowledge of how the organization runs and what the share of his department is in the overall picture. With such a background the engineer can expect to get, and should get, as much or more salary than anyone else with comparable status. On the other hand, the engineer who allows himself to become a mere skilled technician, can expect always to be a painful distance from the top of the pay scale. Pride in the engineering profession and a determination to render the maximum of skilled and high-level service are essentials.

Keeping Up With the Joneses Is Necessary In Engineering Too

OUR BIG highway program is going to bring many changes for folks in the public works field. Things are going to happen: For instance, factories, shopping centers and residential areas are going to spring up where corn, grass, weeds and farmlands are now. Every such development is going to bring problems and either headaches or a sense of gratification to many engineers. The headaches will be for those who sat on their hands or fiddled with petty problems while the rest of the world was going by. The sense of gratification will be for those who looked forward, made flexible plans and solved the problems that developed.

The Joneses of the road-building industry are going ahead; the business and industry Joneses will go ahead too. The Joneses concerned with water, sewage, refuse, health, feeder highways, local traffic, zoning and a lot of other matters had better go ahead too, or someone else will do the job for them—probably not so well, but they will do it. Things like this do not wait.

Electronics and Mechanization Will Affect Engineers

THIS APPROACHING revolution in engineering which involves such things as air mapping, electronic computation from aerial photos for computing cuts and fills, use of design

standards and similar devices to cut down on engineering hours is both inevitable and desirable. However, it isn't going to be all beer and skittles. It will approach, in its nature and its effects, the industrial revolution of a century ago, though much smaller in scope.

One problem will be, of course, to fit a lot of rigid-minded engineers into these new positions. This will often be painful and difficult; sometimes there can be no fit. So one of our present problems is to find useful and rewarding work for those men who, for one reason or another, cannot work efficiently under this new system. Another problem that needs immediate consideration is whether or not our engineering colleges are training their students, technically and psychologically, for this new type of engineering.

These problems are only two of many that will have to be solved in the next few years; it is time to start thinking about them and about all of their brothers and sisters and cousins if we are to progress in the broadest possible way—and in the way that many of us like to think about engineering.

It Is Time to Expand the Horizons in Engineering

OVER THE PAST few years there has been a marked increase in salaries for college graduates just entering into engineering. In the same period, there has not been any comparable increase in pay for the older men who have been on the job for eight or ten years. Though some state highway departments have made a beginning of solving this problem, many or most of our public service agencies have not done so.

Obviously there is a limit to salary increases unless the work performed increases in responsibility and scope. Therefore, it is the responsibility of men in such positions as directors of bureaus and divisions to initiate needed and worthwhile projects, turning the prosecution of these over to experienced younger men and permitting their development and advancement. We are not talking about so-called "made" work; in every department of public service there are jobs that need vitally to be done. It takes a bit of imagination, energy and organizing ability to get them successfully under way. Doing that is the responsibility of the engineer in charge. If he accepts that responsibility, opportunity for growth can come to a good many of the younger engineers; and with it better salaries and better living.

COAST TO COAST...



Daytona Beach, Fla.—16" flexible joint cast iron pipe being installed for water line crossing Halifax River.

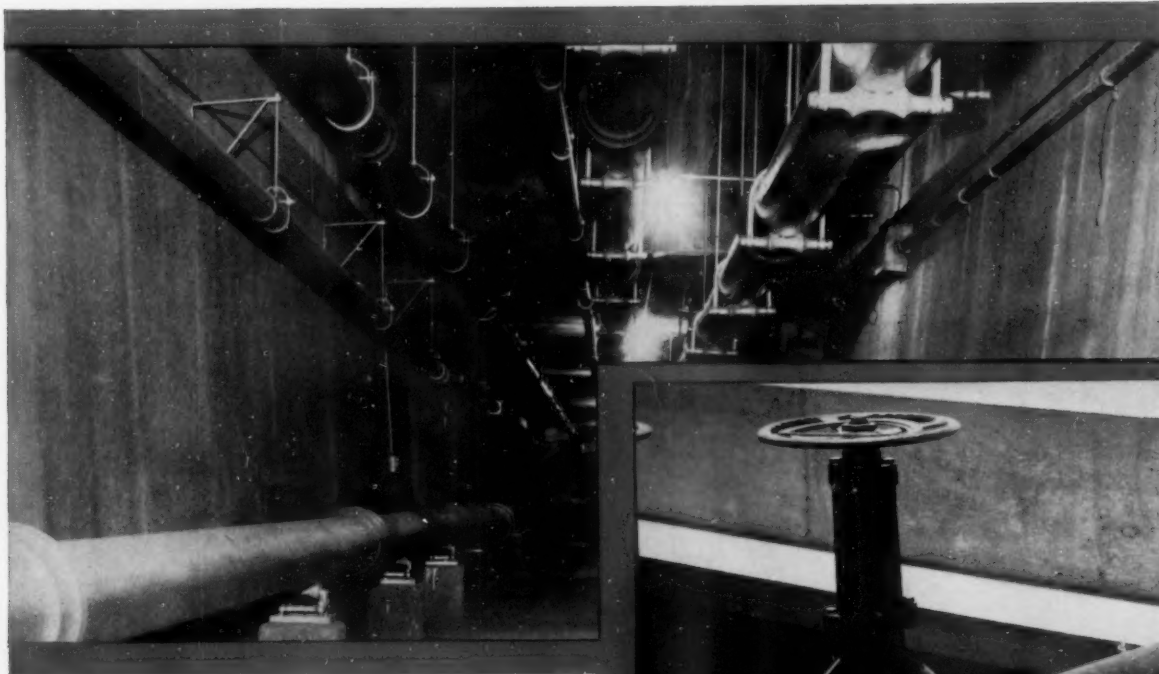
Across the nation, thousands of forward-looking communities use cast iron pipe for their water, gas and sewerage systems. For good reason! Nearly seventy American cities are still being served by cast iron mains laid over a century ago. This outstanding record for long life is unmatched by any other pipe!

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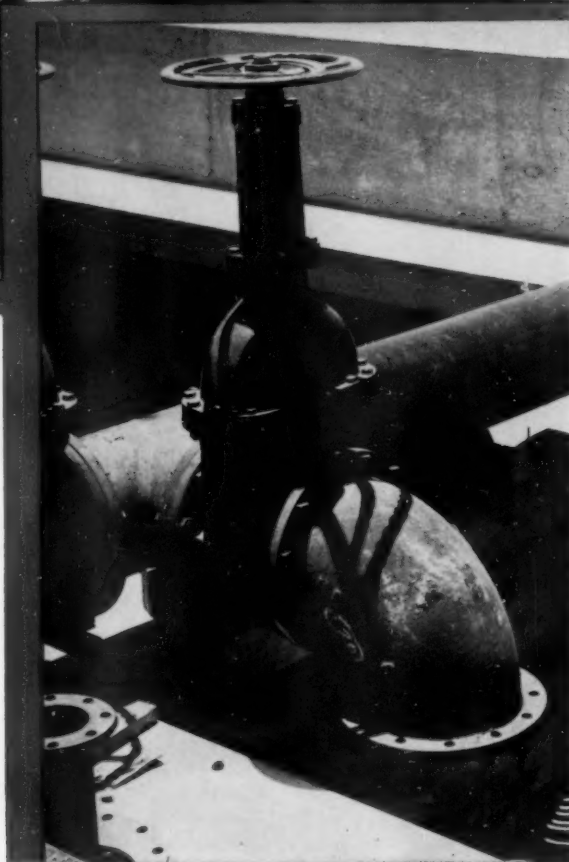
CAST IRON PIPE

IT'S CAST IRON PIPE



Cleveland, Ohio—Over one half million gallons of sludge are pumped daily through 13 miles of 12" cast iron force main to the Southerly Sewage Treatment Works.

Portuguese Bend, Calif.—Cast iron pipe and fittings for salt water line at Oceanarium, Marineland of the Pacific.



Cast Iron Pipe Research Association, Thos. F. Wolfe,
Managing Director, Suite 3440, Prudential Plaza, Chicago 1, Ill.

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HAPCO Aluminum Standards met these strict requirements for beauty and service as well as the plus values of lighter weight and ease of installation. They

are particularly well suited to the foggy, salt-laden atmosphere of the San Francisco area. To demonstrate, the city's Bureau of Light, Heat and Power conducted a three year test of the poles after which a close examination revealed no signs of deterioration.

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APPLETON, WISCONSIN

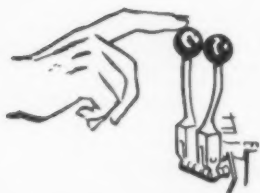


Time the cycle, compare the price...see how **FORD GIVES YOU MORE!**



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Ford Loader leaves side of tractor open. Wide, low step-plate enables operator to move quickly, safely, and easily into seat, with no climbing. Plenty of elbow room, good visibility.

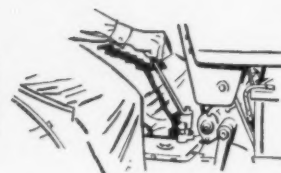


Instant Hydraulic Control

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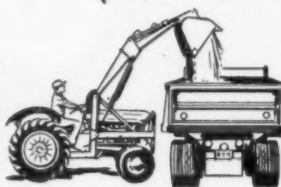
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You see more

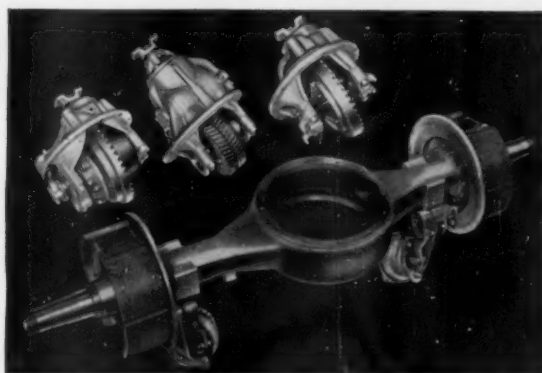
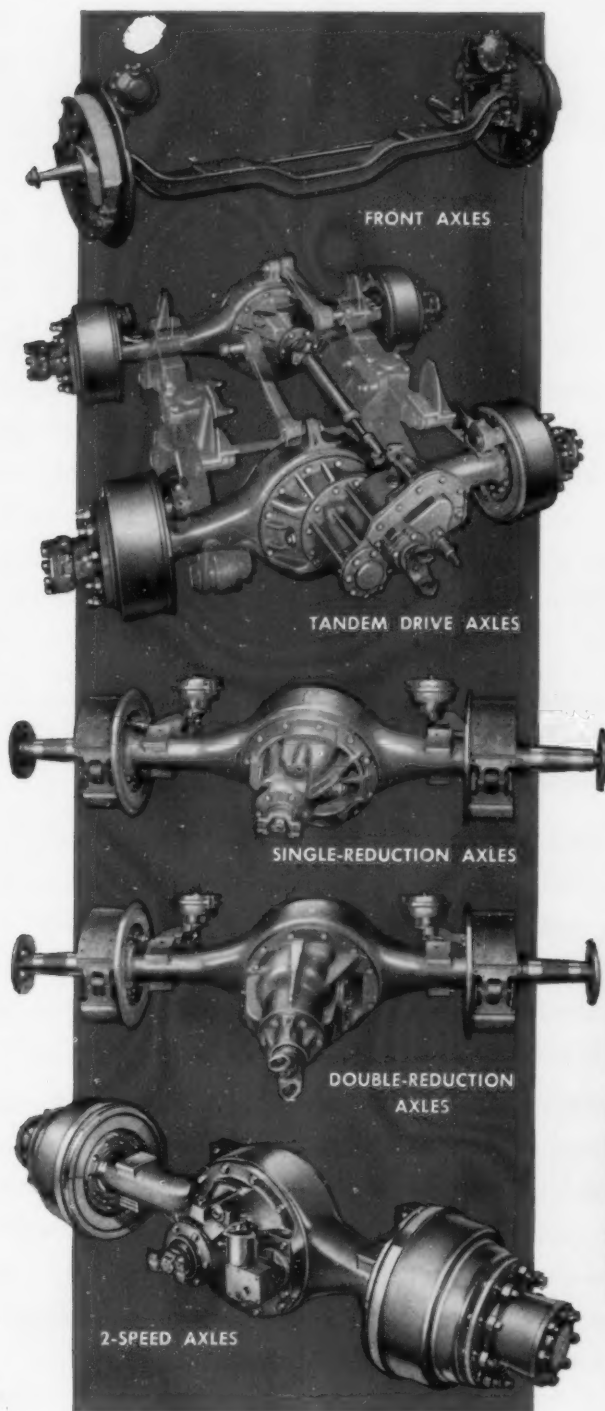
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10

LUDLOW & Rensselaer

LUDLOW RENSSELAER VALVES & HYDRANTS

Since 1861 THE LUDLOW VALVE MANUFACTURING CO. Troy, N. Y.

VALVES and HYDRANTS

RENSSELAER

SINCE 1885

VALVES: A.W.W.A. valves in sizes from 3 to 48 inch are available in both the Ludlow and the Rensselaer types, and prompt service on spare parts will be continued. A comprehensive choice of valve ends, by-passes, and actuation and indication devices is available for any size valves.

HYDRANTS: Two Ludlow and one Rensselaer type hydrant provide an unusual choice which can be presented by any Ludlow office. The bulletins describe a complete line of variations and accessories.

CHECK VALVES, AIR VALVES, TAPPING SLEEVES AND VALVES, and other devices that insure reliable operation of the system over a long period of time and reduce the original installation costs and the cost of extensions, are available in many types and sizes.

SERVICE: The names Ludlow and Rensselaer on water works equipment will continue to mean quality, reliability and service, as they have for nearly a Century. An enlarged list of sales offices in major cities will expand our local services and insure that the traditions of these two respected names will continue.

BULLETINS AVAILABLE ON ALL PRODUCTS.

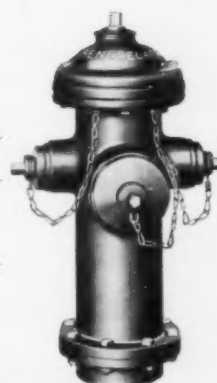
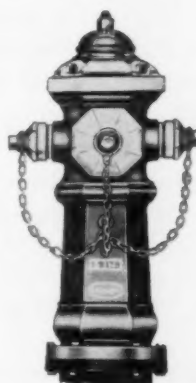
"SEE EXHIBIT BOOTH NOS. 514 and 516"



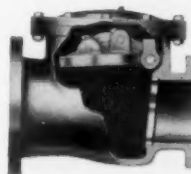
NRS VALVE



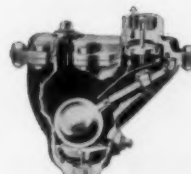
GEARED VALVE



HYDRANTS



CHECK VALVE



AIR VALVE

LUDLOW & Rensselaer

VALVES & HYDRANTS

Since 1861 THE LUDLOW VALVE MANUFACTURING CO. Troy, N. Y.

MUELLER® directory

*of water works
distribution and
service products*

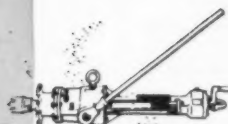
Mueller offers the most complete line of water distribution and service products — a line backed by a century of manufacturing experience and produced under a rigid standard of quality in workmanship and materials. You are assured of years of dependable service. Standardize on the Mueller line!

MUELLER PRODUCTS

...Dependable since 1857—for a century, Mueller Co. has been serving the progress of the water industry. Many new products, introduced during this first 100 years, have become the standard of the industry.

Clip These Pages as a handy reference

Sections referred to will be found in Mueller Water Works Catalog W-96. If you have mislaid your copy, or have need for another, contact your Mueller Representative or write direct.



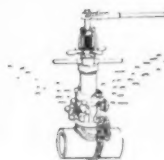
Drilling Machines

For cuts ¼" through 12" under low or high pressure... Simple operation of machine keeps drilling operation under control at all times. (See Section 1).



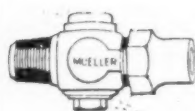
Power Units

Air motor or gasoline engine drive unit may be used with the Mueller "C-1" or "DH-2" Drilling Machine for fast drilling operations. (See Section 1).



Tapping Machines

Drill and tap holes ½" through 4" ... Insert corporation stops ½" through 2" or pipe plugs ½" through 4" under pressure. (See section 1).



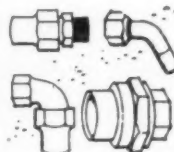
Corporation Stops

Mueller, Iron Pipe, Hall or Wood Main inlets... For thin-wall or small diameter pipe... For Copper service pipe... With lead flange or wiped joint... (See section 2).



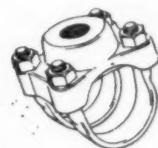
Lead Goosenecks

Single in wiped joint, lead flange and solder joint types... Two, three, four, six and eight branch in wiped joint or lead flange types. (See Section 3).



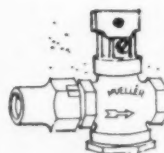
Service fittings

Copper Service Pipe... Service pipe fittings and tees... Branch connections... Corporation stop couplings... Lead flange fittings... Solder nipples and plugs... (See section 4).



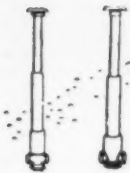
Service Clamps

Single or double strap types with neoprene or lead gaskets... Mueller or I.P. Thread. (See Section 5).



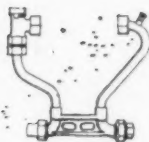
Curb Stops

Inverted key—copper service pipe or I.P. threads. Solid tee head—copper service pipe or I.P. threads. "H" pattern—copper service pipe or I.P. threads. Newport Pattern—I.P. threads. Lead flange or wiped joint. (See section 6).



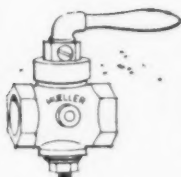
Curb Boxes

Mueller extension type, arch pattern with optional footpiece or Minneapolis pattern... screw type with 2½" or 3" shaft, enlarged or bell bottom base for curb stops or wheel handle valves... Extensions and repair lids. (See Section 7).



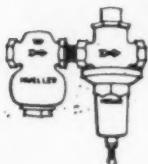
Meter Setting Equipment

Copper meter yokes... Iron meter yokes... Meter relocaters... Water meter couplings... Meter box covers... (See section 8).



Rough Plumbing

Ground key stops with or without drain... Compression stops with or without drain... Sediment and lawn faucets... Bronze gate valves... Ground key stops, angle pattern, with or without drain. (See Section 9).



Regulators and Strainers

For water, air, oil, gas or steam installations... Pressure relief and check valves... Temperature relief valves and relief elbows... Large diaphragm relief valves. (See Section 10).



Tools

Pipe jointers, calking sets, yarning irons, hammers, chisels, flanging tools, copper service pipe tools, lead pipe flanging tools. (See Section 11).



Fire Hydrants

AWWA Improved, in 4¼", 4½", 5¼" and 6¼" sizes... Standard and flush types in 4¼" and 5¼" sizes... Standard and flush types in 2½" size... Underwriter approved type in 5¼" and 6¼" sizes... Variety of ends for different kinds of pipe. (See Section 12).



Gate Valves

AWWA Non-Rising Stem

Hub, flanged, hub and flanged... Spigot, hub and spigot, flanged and spigot... Mechanical joint... Flanged and Mechanical Joint... Universal, flanged and Universal, screwed... Hub for asbestos cement... Hub for steel pipe...

AWWA Sliding and Rising Stem

Flanged...

AWWA Outside Screw and Yoke

Hub, flanged, screwed...

(See section 13).



Cut-In or Tapping Valves

Tapping valves for use with tapping sleeve or cross... Calked and mechanical joint types... Conventional or "O" ring stem packing... With or without indicator post flange... Cut-In Sleeve and Valve with conventional or "O" ring stem packing. (See Section 14).



Sleeves

Split repair and tapping... Calked or mechanical joint types... Tapping cross with calked or mechanical joint also available. (See Section 14).



Inserting Valves

For inserting into mains while under pressure... Non-rising stem with Conventional packing... Gate valve mechanism is identical to Mueller AWWA Gate Valves. (See Section 15).



Valve Boxes

Two or three-piece type, extension pieces, adapters and bases... Roadway screw type with arch or flange base and extension. (See Section 16).



Miscellaneous Valves

Check, flap, mud or plug drain valves, shear gates, floor and bench stands, and indicator posts. (See Section 17).

Visit our new miniature water works distribution display at the main entrance of the convention hall in Atlantic City, May 12-17, 1957.



MUELLER CO.
DECATUR, ILL.

Factories at: Decatur, Chattanooga, Los Angeles;
In Canada: Mueller, Limited, Sarnia, Ontario

Since 1857



ALL OVER
AMERICA



New York City Lighting Engineers Choose KERRIGAN Standards

1650 25-foot KERRIGAN Weldforged Lighting Standards, topped by angled fluorescent luminaires, now turn New York's once dingy Third Avenue into a broad, bright shadow-free thoroughfare. Tall, continuous-tapered, and hot-dip galvanized, the 7-gauge steel standards meet the highest engineering standards and conform to I.E.S. Street Lighting Codes.

Over a period of years thousands of KERRIGAN

Weldforged Lighting Standards have been supplied to New York City. Many thousands more now light Parking Centers, Parks, Sports Fields and Stadiums, Highways, Streets, and Bridges throughout America! Weldforged of high strength low-alloy steel (or aluminum where needed), Kerrigan standards combine maximum strength and beauty of design. Let us send you detailed descriptions and specifications.



FOR BETTER LIGHTED STREETS, BRIDGES, AND HIGHWAYS THE STANDARD IS



Write for
FREE
Catalog
No. P-57-5.

KERRIGAN IRON WORKS, INC., NASHVILLE, TENNESSEE—GENERAL SALES OFFICE 274 MADISON AVE., NEW YORK, N. Y.



245 hours less greasing time... 245 hours more work time EVERY YEAR!

Time saved by 1,000-hour lubrication intervals on your Allis-Chalmers tractor adds up to 245 hours every year—an extra month of production!

On truck wheels, support rollers and idlers, an exclusive combination of positive, spring-loaded seals and tapered roller bearings keeps out dirt and moisture, prevents loss of lubricant.

For 1,000 tractor work hours, you can forget about every grease point below track level. When it's time for servicing, simple low-pressure flush lubrication replaces old grease completely, eliminates seal popping, prevents damage to seal faces. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

IT'S SIMPLE ARITHMETIC!

	Other Tractors	Allis-Chalmers Tractors
No. of greasings per year (5,000 hr)	up to 500	5
Greasing time (av. conditions)	½ hr	1 hr
Time spent greasing	up to 250 hr	5 hr
PRODUCTION TIME GAINED ... 245 HOURS EVERY YEAR!		

ALLIS-CHALMERS

Engineering in Action



Youth center auditorium at state fairgrounds in Columbus, Ohio. Note walls of cement block, concrete and brick.



Multiple unit Butler building located on the Taylor County Fairgrounds in Abilene, Texas.



Low-cost, all-metal Butler garage with solid bank of doors provides complete protection for vehicles.

Taxpayers benefit by **Butler buildings** *because...*

... they represent the lowest cost way to build well. And they can be used for almost any purpose.

Outwardly Butler buildings differ in appearance, but they share a common method of construction that keeps quality high while holding costs down. Each has a rigid steel frame engineered to its proper requirements in advance. Each has lifetime metal roof.

Although all Butler buildings have this similarity in structure, one can be an all-metal garage, another a spacious warehouse, while a third can be a mag-

nificent public showplace with walls of glass, concrete and metal.

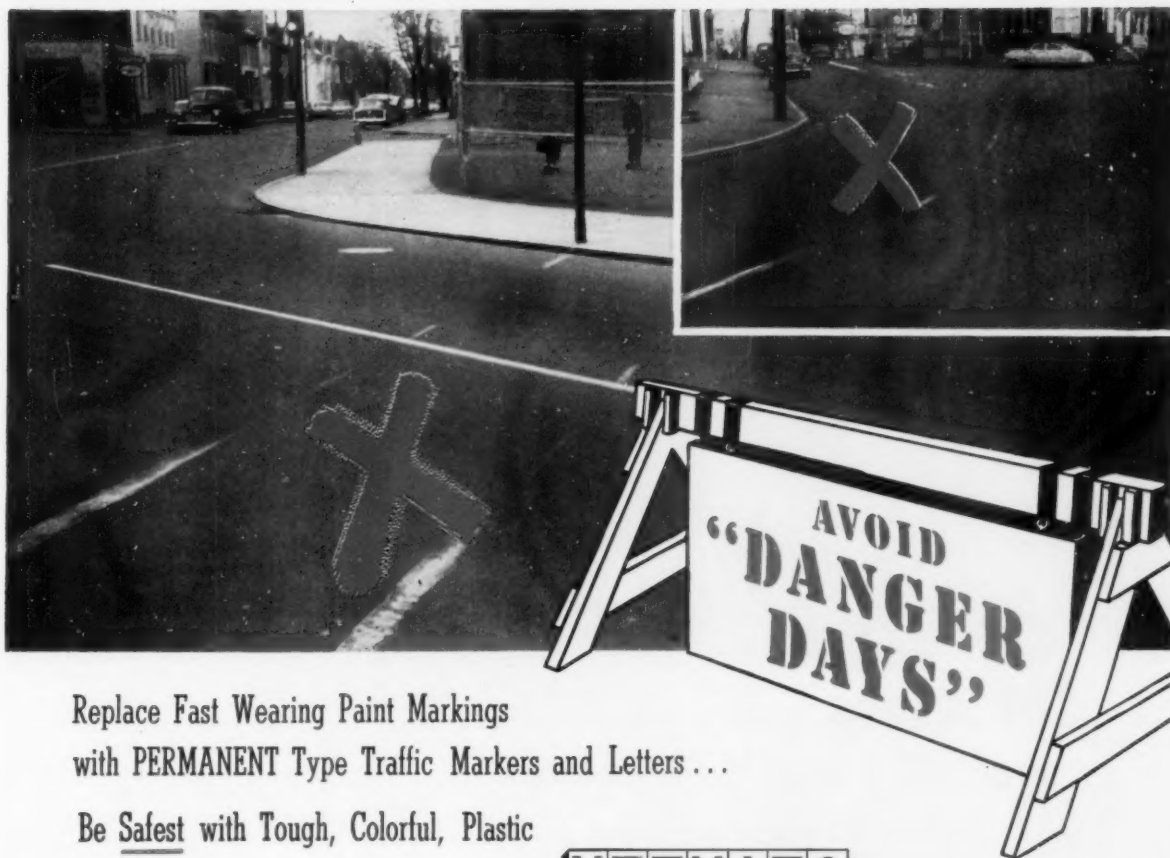
No wonder taxpayers are benefited. Butler buildings provide the economies of mass-production, the individual styling of custom-building, plus unique advantages not available in other methods of construction. Get all the facts from your Butler Builder listed under "Buildings" in the yellow pages of your phone book. Ask to see his sound-slide films on buildings that interest you. Or write direct.



BUTLER MANUFACTURING COMPANY

7321 East 13th Street, Kansas City 26, Missouri

Manufacturers of Buildings • Oil Equipment • Farm Equipment • Dry Cleaners Equipment • Outdoor Advertising Equipment • Custom Fabrication
Sales Offices in Los Angeles, Richmond, Calif. • Houston, Tex. • Birmingham, Ala. • Atlanta, Ga. • Minneapolis, Minn. • Chicago, Ill. • Detroit, Mich. • Cleveland, Ohio
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Replace Fast Wearing Paint Markings
with PERMANENT Type Traffic Markers and Letters...

Be Safest with Tough, Colorful, Plastic

NEFSLABS® and
TRAFFIC MARKERS, STRIPS, ARROWS

NEFMATS
NEW DELUXE TRAFFIC LETTERS

Eliminate the rapid failure of painted lines or other short-lived materials at intersections and on curves! **Prevent** breaks in public safety... dangerous gaps of days or even weeks without the protection of clearly visible traffic markings!

"Traffic-Tested" **NEFSLABS** and **NEFMATS** will justify your investment in their **unsurpassed** quality and **exceptionally** long life—life that is measured in YEARS, not just a few weeks.

They will give you **really reliable** traffic control... with **all-year**, all-weather brightness... and abso-

lutely **no** scheduled replacement... yet with utmost security when bonded tight by cold quick **NEFGLU** adhesive.

Your community certainly deserves the **best**. Let's put **NEFSLABS** and **NEFMATS** to work guarding **your** own public safety. These day-and-night partners direct pedestrians and motorists without any letup!

Test these superior markers, strips, arrows, numerals, and letters in your own area—or write us for "Traffic-Test" references.

*TRADE MARK APPLIED FOR



Famous **NEFSLABS** markers and strips constantly aid safety wherever they are.

Colorful **NEFSLABS** and **NEFMATS** literature is available.

New Sales Territories are Open
for Capable Representatives.

J. W. NEFF
LABORATORIES, INC.
TRAFFIC MARKINGS DIVISION

Stockertown 11, Pa.



NEFMATS one-piece letters roll into place. NO marking, cutting or piecing.



DIXON gave this tank over 11 years protection

By Using Dixon Flake Silica
Graphite Primer and Finish Paints...

Painted properly with Dixon Paints, this 1.5 million gallon water tank in the city of Yonkers, N. Y., was still getting good protection over 11 years later.

This is just one of many such case histories showing that Dixon paints, properly applied, double normal paint life. Unusual? Not at all when you look at actual Dixon customer records running back for 60 years. Nor when you get the full story on the properties of Dixon paints.

Dixon special interior water tank paints are non-toxic, and will not impart an odor, taste, or color to the water. Like the exterior tank paints in the Dixon line, they have flake silica graphite pigments for maximum resistance to atmospheric attack and moisture penetration. Unusual film flexibility allows for expansion and contraction of the water tank without causing the paint to crack or flake.

Ask today for Dixon literature and sample contract forms and specifications showing how to get similar savings in painting your water tanks.



DIXON

JOSEPH DIXON CRUCIBLE COMPANY, JERSEY CITY 3, N. J.

Paint Products Division • Dept. PW-5

Please send me complete information on water tower painting.

Name _____ Title _____
Company _____
Street and Number _____
City _____ Zone _____ State _____



Harry E. Schlenz, President of the Pacific Flush Tank Co., is currently also president of the Water & Sewage Works Manufacturers Association, a well-deserved honor that reflects his leadership and development work in the field of sanitary engineering. His particular interest has been the problem of sludge digestion. He directed early experimental work on this at the Engineering Experiment Station of the University of Illinois, with the first demonstration of two-stage digestion. Later he developed the external heating system for digesters. He is the author of many articles on digestion and is recognized as an authority on the subject. He holds numerous basic patents issued in his name in connection with sewage treatment.

He holds the degrees of BS in Sanitary Engineering, MS in Civil Engineering and CE, all from the University of Illinois. He has been associated with PFT since 1930. Memberships in technical societies include ASCE, AWWA, APWA, Central States Sewage & Industrial Wastes Ass'n. and the Illinois Society of Professional Engineers. He is presently serving on the FSIWA Board of Control. His honors include memberships in Sigma Xi, Tau Beta Pi and Sigma Tau. He was the first recipient at the University of Illinois of the Ira O. Baker award in Civil Engineering.

Mr. Schlenz is rightfully proud of his fine family of three daughters (who own their own horses), a son of pre-school age and his wife Norma who enjoys participation in convention activities and certainly has an important part in planning and carrying out that famous entertainment each year at the FSIWA convention.

REDUCES COST of WORK on STREETS and HIGHWAYS...



SAVES UP TO 50% on Some Jobs

Today, states, counties, and municipalities throughout the nation are successfully reducing the high cost of maintenance work on streets, roads, and highways with Holmes-Owen truck loaders. Use of the standard type loader, such as shown above, can substantially lower the cost of many jobs by simply cutting down on the number of men and equipment needed for such work. With this unit, one man handles all operations. The truck driver LOADS, HAULS, and DUMPS. He does light digging,



grading, and cleaning up, without additional man power or the use of more costly equipment. A truck with such versatile one man operations has many practical uses that can easily lower job cost and actually save thousands of dollars annually for users. The standard loader is hydraulically operated, lifts $\frac{1}{2}$ yard per bucket, loads the average truck in 4 minutes, and can be installed on most $1\frac{1}{2}$ to 2 ton trucks using the standard dump body. See your equipment dealer or write factory for details.

New Forward-Tipping Bucket Broadens USE of LOADER

The Holmes-Owen loader is now available with a new forward tipping bucket that not only improves digging and shoveling operations, but permits the unit to be used for loading other vehicles. This feature considerably broadens the loader's use. It enables the unit to work independently—either loading, hauling or dumping; or, as a unit for loading other trucks. The new type bucket is powered by two double acting cylinders and can be easily rotated to any position up to 120 degrees. The entire loader is hydraulically operated and can be installed on most $1\frac{1}{2}$ to 2 ton trucks. See your dealer or write factory for details.

ERNEST HOLMES COMPANY
Chattanooga Tennessee





New A-Line models range from 1/2-ton Pickups through 33,000 lbs. GVW Six-Wheelers.

NEW ACTION-STYLE! MORE USABLE POWER!

Here is the crowning achievement of fifty years of quality truck production—the great new Golden Anniversary INTERNATIONAL Trucks!

They're *Action-Styled* with fresh, clean functional lines that set a new style pace.

They're powered by new engines that put out more *usable* horsepower—including the most powerful "six"

available in its field! They have exclusive new cab mountings for quieter, more level ride. New brakes, new steering, new frames—and many other new features.

The result is a new line of trucks that—more than ever before—are built to cost *least* to own!

See and drive these newest INTERNATIONALS today! International Harvester Company, Chicago.

Trucks Unlimited... Powered for Modern Traffic... Plus Modern Comfort

Handsome "Golden Jubilee" Pickup with the *longest* all-steel body in its class. Only Panel with third door. New 8-passenger Travelall® models. New cab-forward models with ideal 89-inch BC dimension. Tractors to 48,000 lbs. GCW. Wide range of all-wheel-drive trucks.

Redesigned engines produce *increased* power without strain from new combustion chamber and valve position . . . more usable power that's "bred for the job" . . . at low rpm to keep operating and maintenance costs low. New quick-starting 12-volt ignition.

Biggest windshield—1,181 sq. in.—and *widest* cab in their class! New "Silent-Vent" door wings. New, wider front and rear springs. Exclusive level-riding 5-point cab mounting. Bigger brakes with more lining area, larger cylinders and boosters for quicker, easier stops.

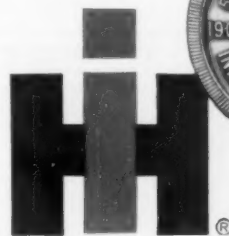


Other INTERNATIONALS, to 96,000 lbs. GVW, round out the world's most complete line.

NEW Golden Anniversary **INTERNATIONALS**

Cost least to own!

Motor Trucks • Crawler Tractors • Construction Equipment
McCormick® Farm Equipment and Farnall® Tractors



INSTANT BRUSH DISPOSAL FITCHBURG CHIPPER DOES 3 MEN'S WORK



Charles Morris feeds roadside brush into Mahwah's Fitchburg Chipper.

When you want to cut brush disposal cost, investigate a Fitchburg Chipper, a real time and labor-saver.

John Glasgow, Superintendent of Public Works, Township of Mahwah, New Jersey, says: "Now I chip brush instead of putting it on piles and waiting for wet weather to burn. I mention wet weather because of fire hazard.

"The Fitchburg Chipper was purchased in May 1954. It will take only a short time to pay for itself. I hired 6 men to cut and clean up brush, now with the Chipper I only need 3 to do the same work."

You, too, can save man hours where there is a need for line clearance operations, road clearance, thinning out woodlots, or handling the brush problem on parkways, city streets, etc.

The Fitchburg Chipper is designed for rugged use, and in models priced from \$960 upward.

Learn about Fitchburg's exclusive spring-activated feed plate, which makes chipping of all sizes of wood (up to the machine's rated capacity) simple. Another exclusive feature is the hinged feed apron which can be closed when not in operation.

Read how others cut labor costs with a Fitchburg Chipper—the only chipper that gives you a one-year guarantee.



Send For New Free Booklet "CHIPPER TALK"

Complete cutaway color drawings and photo copies of letters from many municipalities, commissions, counties, contractors, tree care men.

FITCHBURG ENGINEERING CORPORATION

Dept. PW-57, Fitchburg, Massachusetts

Send my free copy of "Chipper Talk" to:

Name _____ Position _____

Address _____

Town or City _____ State _____

LETTERS TO THE EDITOR

USE OF WATER BY HOTEL

A year or two ago we had occasion to measure the quantity of waste from a high class hotel in northern New Hampshire and the data obtained indicated an average flow of 103 gallons per capita per day. This included cooling water from refrigeration units such as would be found in a hotel of that type. As far as we know no air conditioning cooling was involved.

Francis J. Lariviere
Associate Sanitary Engineer
N. H. Dep't. of Health
Concord, N. H.

GROUND WATER

I have enjoyed your magazine for a number of years for it has many worth while articles in it. Will you please send to Nirian Bates, Bureau of Public Improvements, State House, Augusta, Maine, the September, 1955 issue of your magazine. Starting on page 115 there is a very complete story on "Ground Water." I think that Mr. Bates would also like to have latest copies of "The Water Works Manual and Catalog File" and of "The Sewerage Manual and Catalog File" for his information.

J. Elliott Hale,
Supt., Kennebec Water Dist.
Waterville, Maine

THE HIGHWAY LITTERBUG

The March issue of PUBLIC WORKS contained the article "The Highway Litterbug Costs Millions". Just for the record, we'd like to point out an erroneous figure in the lead of the article, which, perhaps was a typographical error. The U. S. Bureau of Public Roads estimates that it costs some \$50,000,000 annually to clean up litter on primary highways alone in the U. S., rather than the \$5,000,000 cited in the first paragraph.

We read the article with a great



THE RING TRICK

The time-honored ring trick always keeps the audience guessing, and if you like guessing games, perhaps you would like to guess how many tons of steel joint rings went into the construction of the City of Tulsa's 275,000 foot 72" and 66" Lock Joint Concrete Pressure Pipe water supply line. You'll find the answer concealed in the picture above.

But there's no guessing where the fabrication of these joint rings is concerned. Every ring used in the making of Lock Joint's flexible, self-centering and completely

watertight Rubber and Steel Joint is carefully cut, rolled and welded. Then, to assure absolute roundness and exact diameter, every ring is sized on an hydraulic press to such close tolerances that any spigot ring will fit perfectly within any bell ring of like nominal diameter. This is only one of the many quality control measures which go into every phase of the manufacture of LOCK JOINT CONCRETE PRESSURE PIPE, to assure to the customer the highest type pressure pipe obtainable.



LOCK JOINT PIPE CO.

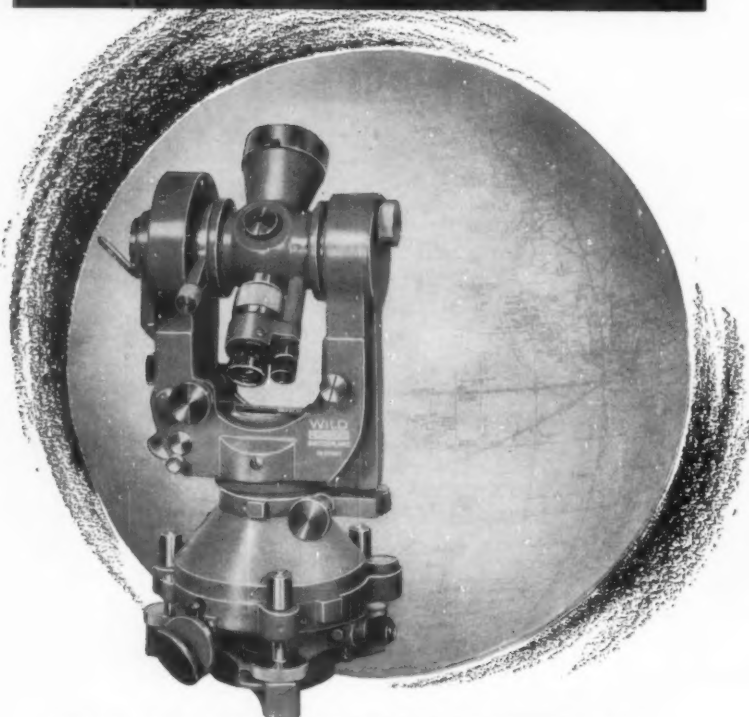
East Orange, New Jersey

Sales Offices: Chicago, Ill. • Columbia, S. C. • Denver, Col. • Detroit, Mich. • Hartford, Conn. • Kansas City, Mo.

Pressure • Water • Sewer • REINFORCED CONCRETE PIPE • Culvert • Subaqueous

WILD®

HEERBRUGG



WILD T-2 UNIVERSAL THEODOLITE

From any point of view...precision, speed, versatility and ease of operation ... here is the WILD instrument that has proved itself the world over, from jungle to ice cap!

Reading on both circles is direct to 1 second. Numerous convenient features include rapid optical plummet centering and large, fatigue-free field of view. Many accessories add to its inherently tremendous work potential.

WRITE FOR THE INTERESTING BOOKLET ON THE WILD T-2 . . . and use the Wild Heerbrugg advisory services without obligation.

WILD HEERBRUGG INSTRUMENTS, inc.

Main at Covert Streets • Port Washington, N. Y.
Port Washington 7-4843

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deal of interest. We certainly agree with Mr. Arthur's statement that "only by educating the public can we expect to solve the litter problem". The ultimate solution does, of course, depend on cultivating attitudes of pride and responsibility for clean surroundings to replace the thoughtless habit of littering.

However, we cannot agree with Mr. Arthur's comment that "no highway department . . . has pushed such a program". Nor can we agree with his lack of optimism about the effectiveness of highway trash receptacles and litter penalty warning signs and his belief that there is little enforcement of litter-control laws.

While we are a long way from permanently eliminating litter from the American scene, we do feel that had Mr. Arthur fully known the scope and achievements of the Keep America Beautiful movement, he would have shared some of our optimism about gains that have been made to date.

We would like to point out that both the American Association of State Highway Officials and the U. S. Bureau of Public Roads are guide the KAB program.

Further reasons for our optimism are exemplified in the most recent issue of our *Progress Bulletin*. This publication's chief purpose is to give a representative report of gains made in all phases of the litter-prevention movement.

In light of the above information, which certainly gives a happier impression of the overall contribution by highway officials toward eliminating the litter problem than that given by Mr. Arthur's article, we are taking the liberty of suggesting that a follow-up article would be of interest to your readers—and also serve of great educational value as a stimulus to further action.

As always, we are most gratified by the continuing cooperation you are giving this movement. We know you will be interested to hear that, a full year after its appearance in the January 1956 issue of *PUBLIC WORKS* magazine, Andrew Mulrain's article "New York City Proves . . . Anti-Litter Campaign Can Be Effective!", in reprint form, is one of our most useful pieces of educational material. It receives a wide circulation from this office, and is being used as a guide for action by cities across the country.

Harriet Ben Ezra
Keep America
Beautiful, Inc.
New York 16, N. Y.

PUBLIC WORKS for May, 1957

MEDINA COUNTY, OHIO, REPORTS ON ITS USE OF THE RECORDAK MICROFILMING

\$3,000 saved per year in recording vital statistics



NO LONGER are vital statistic records, which must be dispatched to the State Department of Health, transcribed by hand for the office record.

Pressing a button on the Recordak Junior Microfilmer ends this tedious job. Lets Medina County handle an ever-increasing volume of work without adding to its clerical staff.



Two rolls of film are shot for extra protection—one set stored off the premises as a precaution against fire, flood or other disaster.

Film records, for office use, are filed at the fingertips—ready for immediate review on film-reading screen of Recordak Junior Microfilmer. Large-size facsimile copies can also be made in this versatile machine directly from the Recordak microfilms.

See how your savings in a few months can pay for the all-purpose Recordak Junior. You can buy one for as little as \$550; or rent one at low monthly charge.

"Recordak" is a trademark

Price quoted subject to change without notice.



RECORDAK
(Subsidiary of Eastman Kodak Company)

originator of modern microfilming—
now in its 30th year

MAIL COUPON TODAY

RECORDAK CORPORATION
415 Madison Ave., New York 17, N.Y. Z-5
Gentlemen: Send literature on Recordak Junior Microfilmer.

Name _____
Position _____
Agency _____
Street _____
City _____ State _____



Work Bulls pay off

in town, city, county, state, federal service



Work Bulls provide the right tractor power with design-integrated attachments — earn an amazingly large return on a small equipment investment.

52 hp

**WORK BULL
MODEL 404**

(left foreground) Biggest and most powerful Work Bull, this money-maker is powered by either gasoline or diesel engines. Machine shown is equipped with hydraulically controlled backhoe (handles 12 to 36 in. buckets) which swivels through 180°, digs to depth of 12½ ft. Front-end equipment includes ¾ yd. loader, broom, blades, fork lift and snow plow. Same hydraulic arms handle all these attachments. Result: Multiple machine versatility at extremely low cost.

34 hp

**WORK BULL
MODEL 202**

(left background) Low-silhouette tractor can be equipped with reel, rotary or side-mounted mowers. Other attachments include loader, hoe, post hole digger, pipe and cable layer, utility boom, fork lift, dozing or grading blades and a hydraulically controlled 5-ft. broom.

42 hp

**DAVIS
PIT BULL**

(right) This low-cost unit frequently outworks much larger, more expensive machines. Torque converter and foot-shift reversing clutches are standard equipment. Unit illustrated is equipped with hydraulically controlled grader blade. Low-thrust principle assures solid "bite," eliminates climbing when the going gets rough. The Davis Pit Bull is available only through M-H-F Work Bull dealers.

... as primary equipment

Work Bulls put former hand work on a paying power basis . . . provide far more versatility than other wheeled tractors in their work range. Work Bulls dig, doze, load, lift, grade . . . mow grass, plow snow, sweep roadways. Work Bulls more than earn their keep year round.

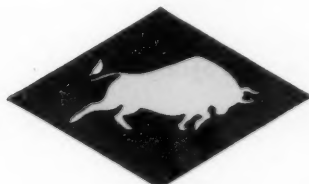
... as backup machines

With Work Bulls you get the exact power/equipment cost ratio the job demands . . . increase efficiency of equipment scheduling . . . cut down overhead. Work Bulls move from site to site through city traffic or cross-country—without permit troubles, without flatbed and other costs.

... as utility or cleanup tools

Low in initial cost, low in upkeep, Work Bulls provide an ideal means of allowing larger, more expensive, single-purpose machines to concentrate on the work they're designed for. Remember, one man, in the field, without special tools can switch any of 20 Work Bull attachments in 5-15 minutes.

Work Bulls have a profitable place on every project. Check to see which of the 5 tractors (34 to 52 hp) and 20 easily interchangeable attachments you need. Write for free 24-pg. catalog and the name of your Work Bull distributor.



M·H·F WORK BULLS

Division of Massey-Harris-Ferguson, Inc.

16-E Quality Avenue

Racine, Wisconsin

Jaeger offers new pumps and higher performance for '57 work



1720 GPM AT ONLY 1400 RPM WITH DIESEL-POWERED 6" PUMP . . . THAT'S ACTUAL PERFORMANCE

With high water, an unstable gravel river bottom and a good sized cofferdam, you do a lot of pumping. This 6" Jaeger "Sure Prime" is the only contractors' pump built that will move well over 100,000 gallons per hour with a 36 hp diesel engine at a fuel-

saving diesel speed of only 1400 rpm. Higher capacities, at lower, engine-saving operating speeds, are characteristic of Jaeger "Sure Prime" centrifugals in all sizes, 1½" to 10". Base your 1957 pump buying on 1957 information. Ask your Jaeger distributor, or write today, for the *guaranteed actual performance* of 1957 model Jaeger pumps in the sizes your work requires.



NEW DIAPHRAGM PUMP HAS SPRING-BOTTOM BOWL

Revolutionary spring-bottom construction of Jaeger "DY" model diaphragm pumps prevents build-up of cement or clay deposits and also protects from shock if stones are sucked into pump. Light weight, free-swinging valves minimize resistance and give quick,

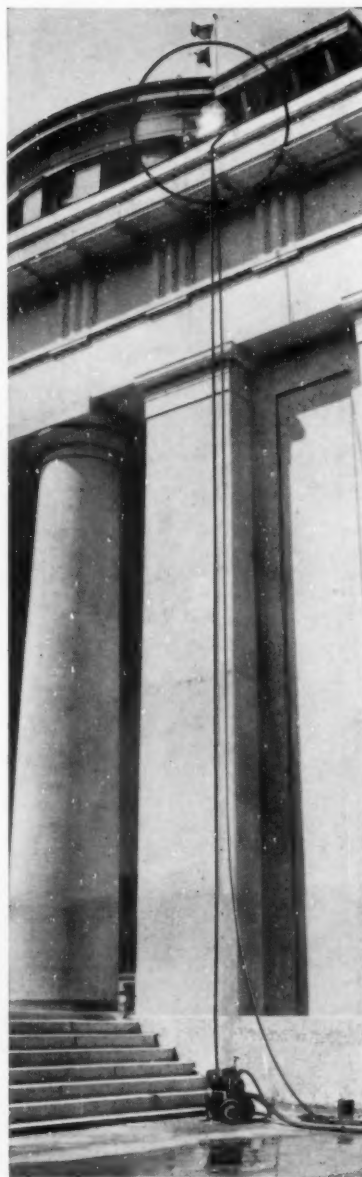
tight closure for high vacuum pumping (4" model handles 4000 gph at 25' suction lift, up to 7000 gph at 10' lift). Surge chamber eliminates "kick", doubles hose life. Merely loosen 4 bolts and tilt frame back to change diaphragm. Built in 3" and 4" models that make other diaphragm pumps old fashioned.

See your Jaeger distributor or write for latest catalog and performance data on Jaeger Sure Prime Dewatering Pumps, Diaphragm Pumps, Pressure Pumps or Well Point Systems.

THE JAEGER MACHINE COMPANY

400 Dublin Avenue, Columbus 16, Ohio

AIR COMPRESSORS • CONCRETE MIXERS • TRUCK MIXERS • SPREADERS • FINISHERS



VERTICAL HEAD IS 143'; PUMP IS A 2" JAEGER "SURE PRIME". The dual-purpose model 2PAFH gives you high pressure plus sizeable capacity. On this sandblast cleaning job, Midair Construction Co., Akron, Ohio, used it to pump wash-down water to the dome of the Ohio Statehouse, 143' above pump location. On supply work it will deliver 65 gpm at 60 lbs. pressure; on drainage jobs it will move 140 gpm (8400 gph) at 10' suction lift.

55% LESS KICK

with the NEW **LE ROI** shock-absorbing handle

The girl is
Virginia DeLee,
5' 8", 124 lbs.,
35-22-35

It's the hottest thing on rock drills yet! The new torsion rubber-cushioned handle on Le Roi sinkers cuts out 55% of all vibration normally delivered by air tools to the worker . . . yet doesn't lose an ounce of impact at the bit!

That means a lot less fatigue—higher output per day—bigger smiles at the end of the shift. And workers stay on the job longer when work is eased with better tools.

You get dependability, too. Like all Le Roi Newmatic Tools, the shock-absorbing handle is built for years of service life.

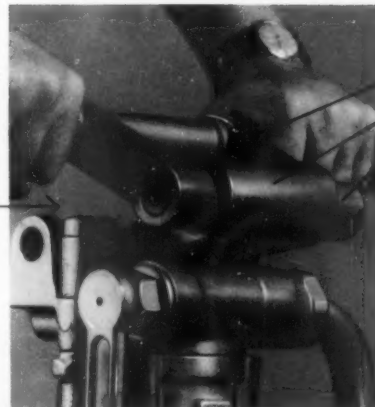
That's a lot of return for a low investment — see these new, new tools at your Le Roi distributor now. Le Roi Division, Westinghouse Air Brake Co., Milwaukee 1, Wisconsin



LE ROI NEWMATIC AIR TOOLS

a torsion rubber cushion in
the handle — adjustable to suit the operator —
dampens most vibrations.

55% of all tool-shock stops here!



Rubber grip handles
Torsion rubber cushion
Handle adjustment

...and you can wear
a wrist-watch, too!



Le Roi Model DR40
Wagon Drill for
deep drilling,
hard ground



Le Roi Model DR34
with H10 Drill for
shallow drilling in
average ground (also
with H23 Drill for
medium drilling in
hard ground)



Le Roi Model H111
Heavy-duty Sinker
for deep drilling,
hard ground (55 lb.)



Le Roi Model H10
General purpose
sinker for average
ground (45 lb.)



Le Roi Model H166
Sinker for shallow
drilling (35 lb.)

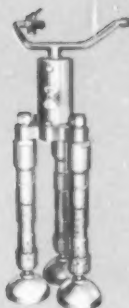


Le Roi Model 22
Sinker for utility
work (17 lb.)



**Le Roi Air Operated
Sump Pump** —
capacities to 340
gpm, heads to 70 ft.

Le Roi Model OT11
Triple Hand
Tampers for all
applications



Le Roi Model 11
Single Hand
Tampers for all
applications



Le Roi Model C10
Demolition,
light-duty Paving
Breaker (35 lb.)



Le Roi Model 31
Clay Spade for
average ground
(18 lb.)



Le Roi Model C100
Clay Spade for
hard ground (35 lb.)



Le Roi Model C11
General-purpose
Paving Breaker
(60 lb.)



Le Roi Model 52
Heavy-duty Paving
Breaker for tough
concrete (80 lb.)



BE EMPHATIC... SAY LE ROI NEWMATIC!



A complete line of air tools for the
construction industry...balanced for
operator comfort...air-cushioned
for long life...precision built for
dependable operation.



Le Roi Division, Westinghouse Air Brake Co.
Milwaukee 1, Wisconsin



Rowe Construction Co., Bloomington, Illinois, uses the Model 374 Conveyor, one of many types and sizes of Barber-Greene portables.

The president of Rowe Construction Co. reports

**"Our next portable conveyor
will be another Barber-Greene"**

"We have given our Barber-Greene conveyor four years of hard service and its performance has been tops. We produce sand and gravel for highway departments and for our own use. So we move our plant three and four times a year. Towing our conveyor from job to job presents no problem at all. We just hitch it up to a truck and move out.

"And it was no big job to lengthen our conveyor from 51 to 60 feet. All we did was order a nine-foot intermediate section and bolt it into place. All carriers, returns and decking were already in place and aligned.

"With this kind of reliability and easy flexibility, we feel sure our next portable conveyor will be a Barber-Greene."

Straight-forward reports like D. H. Rowe's provide the proof of the superior performance and widespread acceptance of Barber-Greene conveyors. Handling coal, sand, gravel and other bulk materials, these versatile conveyors operate on a virtually automatic basis... cut labor costs substantially.



Not just portability, but road-ability is one of the many features that save time and money for the Rowe Construction Co.

Literature shows the many superior features of Barber-Greene portables. Write for your copy.

56-21-PO

Barber-Greene

AURORA, ILLINOIS, U.S.A.

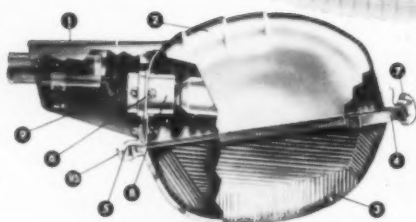


CONVEYORS...LOADERS...DITCHERS...ASPHALT PAVING EQUIPMENT

PUBLIC WORKS for May, 1957

37

New Westinghouse



Check EVERY ONE of these Incomparable Westinghouse Features

1. Cast aluminum slip-fitter for 1 1/4" pipe. 2. Heavy, drawn-aluminum reflector, with Alzak process finish. 3. Westinghouse exclusive Holophane refractor. 4. Die-cast aluminum globe ring. 5. 100% wool non-moisture-absorbent gasket. 6. Moisture-dirt- and bug-proof gasket seal. 7. Stainless-steel pressure latch. 8. Porcelain-clad socket. 9. Wiring terminals easily accessible. 10. Hinged globe gives easy maintenance! **AND—A SIMPLE MOVE OF SOCKET FLANGE AND GASKET to inside of reflector ALTERS TYPE OF LIGHT DISTRIBUTION!**

GIVES IDEAL TYPE II
LIGHT DISTRIBUTION



SIMPLE INSTALLATION MOVE
GIVES TYPE I DISTRIBUTION



Local Residential Streets,
Secondary Streets, Suburban Thoroughfares

... where people live ...

Now get 2 to 3 times more light! ...
at no appreciable increase in cost!

There is now a mercury luminaire that provides new levels of lighting, pronounced safe and comfortable for residential streets, at almost startling low cost!

This luminaire, named the Westinghouse OV-10, simply permits additional specific applications of remarkably efficient, new-type, mercury lamps—which commonly are now known to supply business thoroughfares with 200% to 300% more light!—at only nominal increase in cost!—over that for old-style street lighting!

In addition, this new OV-10 luminaire has been engineered identically to match, and to complement, the improved Westinghouse series of OV-20, OV-35 and OV-60 luminaires.

Moreover, this is the famous OV luminaire group that solves virtually every roadway lighting problem. These are the OV luminaires you've heard about—delivering today, throughout countless thousands of applications, 2 to 3 times more light!

OV-10 Mercury Luminaire



now brings to residential streets SAME IDEAL-TYPE ILLUMINATION DEMANDED BY MERCHANTS!

Has same sealed-in, advanced, optical system;
same ease, speed, economy of installation
and maintenance

See the entire list of special design refinements, exclusive Westinghouse features, of this new, OV-10 luminaire, shown in cut-away illustration at left, including: heavy-gauge aluminum housing and cast aluminum slip-fitter—highly efficient Alzak reflectors—and precision designed refractors, delivering maximum lumens-per-watt to the roadway!

Westinghouse leads all others in the design and development of mercury illumination for all roadway lighting applications

Now this new, OV-10 luminaire enables your Westinghouse representative to assure you of *Residential Street Lighting* with *ideal*

illumination for each particular purpose, at lowest costs practical today!

The OV-10 utilizes the following mercury lamps:

L-H4	100 Watts	3,300 Lumens
A-H22	175 Watts	6,800 Lumens
C-H5	250 Watts	11,000 Lumens

Accept



complete information, helpful application data, in folder on this new, advanced, Type OV-10 luminaire. Get folder from your Westinghouse sales representative. Or write Westinghouse Electric Corporation, LIGHTING DIVISION, Edgewater Park, Cleveland, Ohio.

J-04409



YOU CAN BE SURE...IF IT'S **Westinghouse**

PUBLIC WORKS for May, 1957

EQUIPMENT and MATERIALS

FOR
YOUR

PUBLIC WORKS PROGRAM

NEW LISTINGS

Bituminous Distributor For Highway Maintenance and Construction

650. The Littleford distributor offers a full circulating mechanically operated spray bar, and the bar is raised by hydraulic system. For specifications and operating data write Littleford Bros. Inc., Cincinnati 2, Ohio.

1/2-Yard Trencher and Swing Loader

651. The Oliver 1/2-yard trencher and swing loader is described fully in literature from The Oliver Corp., 400 West Madison St., Chicago 6, Ill. Check the reply card for features, operation and uses of this trencher.

Plastic Pipe For Water Lines

652. Applications and advantages of polyethylene pipe are covered in literature from Chesflex Corp., 684 Nepperhan Ave., Yonkers, N. Y. Specifications and data on sizes are included. Check the reply card today.

Construction Guide For Engineers and Builders

669. A 34-page four sectioned construction guide containing full-page structural drawings that provide basic information on types, grades



and applications of fir plywood for engineers and builders has been released by Douglas Fir Plywood Association, Tacoma 2, Wash. Check the reply card for data on floor construction, single and double wall construction and roof construction.

Calcium Chloride in Pellet Form

653. The pellet form of calcium chloride enables it to melt winter's ice faster, and in dust laying in either a dry or in water solution, is described in literature available from Wyandotte Chemicals Corp., Michigan Alkali Div., Wyandotte, Mich. Check the reply card for information on the uses of calcium chloride.

Self-Propelled Black Top Paver

668. A self-propelled paver that handles both large and small black top jobs is described in literature from Trac-Machinery Corp., Dept. C, Nunda, N. Y. Features are heated screed, crowning device, pushes truck with ease, 7-ft. turning radius, 8, 9 and 10-ft. paving widths. Check the reply card.

The engineering information in these helpful catalogs will aid you in your Engineering and Public Works programs. Just circle numbers you want on the reply card, sign and mail. This free Readers' Service is restricted to those actively engaged in the public works field of cities, counties or states.

Biosorption Activated Sludge Plant

654. The "Biosorption" plant treats sewage and industrial wastes by a high rate activated sludge process. Flow diagrams, equipment and design of plants are covered in bulletin from Infileo Inc., Tucson, Ariz. Check the reply card.

Catalog on Road Rollers and Compaction Equipment

667. Two and 3-axle tandem rollers, 3-wheel variable weight rollers and the Kompactor are covered in this catalog from Buffalo-Springfield Roller Co., Springfield, Ohio. Specifications, models and features are included. Check the reply card today.

Data on Roadside Seed Bedder

659. Bulletin 57 describes a roadside seed bedder that rakes, levels, grades, harrows, scarifies and cultivates in one easy operation. It also spreads and levels cinders, sand and stone for driveways and parking areas. For full details check the reply card or write Dotmar Industries Inc., 502 Hanselman Bldg., Kalamazoo, Mich.

Literature on Diesel and Dual-Fuel Engines

660. A complete file of literature on diesel and dual-fuel engines in the 225 to 1025 hp range is available from White Diesel Engine Div., The White Motor Co., Springfield, Ohio. General dimensions, specifications, performance horsepower and kw ratings are fully covered. Check the reply card.

Weather Engineering For Profit

661. In this book, Weather Corp. of America presents the case for investigation of its complete services, through the experience record of certain basic industries and an informed projection of that experience into newer uses and fields. Check the reply card or write Weather Corp. of America, 611 Olive St., St. Louis 1, Mo. for information on weather problems.

Controls For Use in Pumping Stations and Sewage Plants

662. Single and multi-pump sump controls, pressure operated for use in pumping stations and sewage disposal plants are described in literature available from Healy-Ruffi Co., Water Level Controls Div., 2255 University Ave., St. Paul 14, Minn. The two principal types of pressure operated sump controls are covered along with general descriptions and features. Check the reply card.

Self-Priming Centrifugal Pumps For Construction

655. Sizes, capacities, reference tables for selection of the proper pump, performance charts and uses of centrifugal pumps are covered in literature from Barnes Mfg. Co., Mansfield, Ohio. Check the reply card for the latest information on Barnes pumps.

Cutter For Eliminating Bumps in Concrete and Asphalt Surfaces

656. A precision bump cutter that eliminates bumps in concrete or asphalt surfaces quickly and economically is described fully in literature from Concut Sales, Inc., 1845 Belcroft St., El Monte, Calif. Check the reply card for operation and specifications of this machine.

Design of Concrete Pavements For City Streets

657. Sections covered in this manual are classes of streets as to traffic, quality of concrete, working stress and safety factor, types of pavement design, design procedure, jointing of municipal pavements and use of distributed steel. Check the reply card or write Portland Cement Association, 33 West Grand Ave., Chicago 10, Ill.

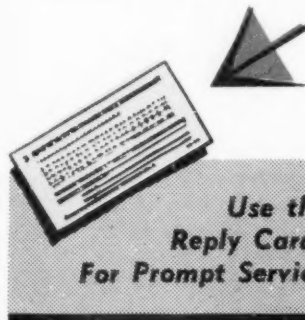
MORE LISTINGS ON PAGES 42 TO 60

Data on Heavy-Duty Bar Screens

658. Schematic drawings, engineering data and photos of applications of bar screens are covered in a bulletin from Chain Belt Co., Milwaukee 1, Wis. Check the reply card for information on these mechanically cleaned bar screens.

Technical Bulletin on Cushioned Float Valves

666. Golden-Anderson cushioned float valves maintain accurate water level control in elevated tanks, reservoirs, coagulating basins and mixing chambers. Parts lists, dimensions, approximate shipping weights for the various sizes, operation and installation on each of the various types of float valves is contained in a bulletin available from Golden-Anderson Valve Specialty Co., 1244 Ridge Ave., Pittsburgh 22, Pa. Check the reply card.





**IT WAS
EITHER
THIS**

THE NEW DAVIS BACK-HOE

...the ONLY MACHINE

THAT COULD HANDLE THE JOB ... RIGHT

Ditches at the base of a steep slope can be mean digging — but they are all in a day's work for the new Davis 210 Back-hoe. This unique equipment is the only machine in the world — outside of a man with a shovel — that can dig flush — that is, right next to a wall, building, or at the base of a steep slope where a tractor can't sit level. An exclusive rotary hydraulic boom swing cylinder along with three interchangeable mounting points on the frame make it all possible. This permits you to dig directly from behind either tractor wheel ... or from the center ... and it gives you 200° continuous arc with smooth starts and cushioned stops. Add all the other features of Davis — such as 7,000 pounds of breakaway, vertical design, independently controlled hydraulic stabilizers ... five-minute detachability — and you can readily see why you will make more money and do the job faster when you have a Davis! Back-hoe is available truck mounted.

Davis Loaders and Back-hoes are available for all popular tractors and are sold and serviced throughout the U. S. A. by better dealers.

For the name of nearest dealer call Western Union by number and ask for Operator 25 ... or write for literature (specify make of tractor.)



MID-WESTERN INDUSTRIES, INC.
1009 SOUTH WEST DEPT. P WICHITA, KANSAS



You'll recognize this other profit-maker — the Davis Loader — on construction and maintenance jobs where the owner has an eye for quality and demands equipment that will stand the test of time. It's America's premium loader at down-to-earth prices!



...FOR MORE PROFIT

To order these helpful booklets check the reply card opposite page 68.

NEW Litter-Getters

by

TARCO

for all kinds of litter. Tarco Litter-Getters are powerful vacuum type machines . . . carefully designed for picking up: newspapers, paper cups and wrappings, milk cartons, tin cans, pop bottles, ticket stubs, leaves, etc.

Wide use: Any place you have litter a Tarco Litter-Getter cleans it up Faster and Cheaper . . . in city streets; public parks, parking lots, recreation areas, highway shoulders and center malls.

Choice of Models

For Jeep or pick up truck mount- ing: two models each with its own



built-in, filtered litter receiver . . . for city gutter litter (see picture). Two trailer-mounted Litter Getters: one to deliver litter into large truck-mounted boxes. Other trailer-mounted unit . . . with a built-in litter receiver . . . for use on highway shoulders and center malls or where turf may be damaged by heavy vehicles.

TARRANT Manufacturing Company

28 Jumel Place, Saratoga Springs, N.Y.



Put **WARN HUBS**
on your
'Jeep'

Stop Front Drive Wear in 2-Wheel Drive

Warn Hubs on your 4 w.d. will reduce front drive wear in exact proportion to the miles you drive in 2 w.d.! Watch your mileage, and you will find that you use 2 w.d. most of the time. With Warn Hubs, the front drive is "idle" in 2 w.d.—nothing turns but the wheels. There is no wear, no drag, no front gear whine. Your 4 w.d. has more pep, speed and power in high, and steers easier.

For maximum convenience, install Warn Lock-O-matics. They automatically engage the front wheels for 4-wheel drive, and disengage them for free-wheeling 2-wheel drive, as you shift! Warn Locking Hubs have easy fingertip controls. With either model, you'll get better, more economical service from your 4 w.d. See your local 4 w.d. dealer today. Free literature.



APPROVED MODELS FOR
ALL 4 W.D.s. TO 1 1/2 TONS



WARN MFG. CO.

Riverton Box 6064-P5,
Seattle 88, Washington

Chains For Conveying, Elevating and Power Transmission

663. A 2-color catalog illustrating and describing a complete line of malleable chains is available from Moline Malleable Iron Co., St. Charles, Ill. It covers all types of conveyor and elevator chains and shows the method of installing the chain and how to identify chain attachments. Check the reply card.

Hoists For

Trailer Dump Bodies

664. Fifty-seven hoist models and complete information covering specifications, applications and capacity ratings for hoists applicable to both single axle and tandem axle semi-trailers are covered in literature from The Daybrook Hydraulic Div., L. A. Young Spring & Wire Corp., Bowling Green, Ohio. Check the reply card.

Technical Soil

Testing Manual

665. Written for engineering, laboratory and educational instruction use, this 56-page manual deals with the interpretation, application and limitations of the test data obtained as well as with procedures and testing equipment. Check the reply card or write Soiltest, Inc., 4711 W. North Ave., Chicago 39, Ill., for your copy.

Chlordane Bulletin Aids

Municipal Insect Control

670. The contents of this bulletin cover a wide variety of insect pests, insect habits, insecticide dosages and other aspects of successful municipal insect control. It also serves as a guide in establishing standards for control methods and purchasing specifications. Check the reply card or write Velsicol Chemical Corp., 330 East Grand Ave., Chicago 11, Ill.

For Prompt Service Use The Reply Card

Grass and Weed

Trimmer-Cutter Attachment

671. A one-man, portable grass and weed trimmer and cutter attachment is described in literature from Rowco Mfg. Co., 89 Emerald Street, Keene, N. H. The unit eliminates hand clipping or scything for highway maintenance and parks. Check the reply card.

Reinforced Concrete Pipe

For Culverts and Sewers

672. Elliptical Lo-Hed and Hi-Hed pipe, round pipe and flat base pipe are described fully in literature from American-Marietta Co., Concrete Products Div., 101 East Ontario St., Chicago 11, Ill. Headwall details, discharge curves, hydraulic capacity tables and hydraulic properties are included. Check the reply card.

What You Should

Know About a Motor Grader

673. Photographs, sketches and other instruction illustrations aid readers to visualize details of the Allis-Chalmers Model Forty-Five motor grader mechanical features and components. The catalog also tells about attachments and accessories. Write Allis-Chalmers Mfg. Co., Tractor Group, Milwaukee 18, Wis., or check the reply card for your copy of this catalog.

Information on Duriron

A High-Silicon Cast Iron

674. The Duriron Company, Inc., Dayton 1, Ohio has released a bulletin on Duriron impressed current anodes for cathodic protection. Composition and properties of Duriron, an alloy, are furnished along with the mechanical and physical properties and design. Ground bed, sea and fresh water applications are included with tests results. Check the reply card for your copy.

Refibering Rotary

Sweeper Brooms

675. A smooth, automatic, one-man operation for refibering rotary sweeper broom cores is now possible with the Cor-A-Matic machine, which can refiber a five-foot broom in 12 minutes. For full details on several models write Municipal Research & Development Corp., 1331 Third Ave., Seattle 1, Wash., or check reply card.



New Forward Control Design provides more space because the engine is behind you. It puts a 74" pickup box on 81" wheelbase—record-breaking cargo space per inch of wheelbase. This efficient design makes maneuvering on or off the road faster and safer.

How the New Forward Control 'Jeep' FC-150 saves time and money on public service jobs!



All-Wheel Traction. With the extra traction of its "go-anywhere" 4-wheel drive, the FC-150 provides extra insurance in daily public service use and in emergencies. Yet, it shifts easily into 2-wheel drive for highway travel at top legal speeds.

On job-after-job the all-new Forward Control 'Jeep' FC-150 gets more work done faster, with savings of time and manpower. That's because it's made to order for public service jobs.

Here's a 4-wheel drive truck that gives you maximum cargo space on minimum wheelbase. It maneuvers almost anywhere, with full crew and equipment, where ordinary trucks call it quits. Riding comfort!—you have to test drive it to believe it! There's plenty of head, leg, and shoulder room! The all-new Safety-View cab lets you see terrain as close as 6 feet from the front bumper. It combines with the new wrap-around windshield—largest in the FC-150 weight class—for up to 200% greater forward visibility. With power take-off, the FC-150 has the all-around versatility to operate a variety of special equipment from winches to sprayers.

The new 'Jeep' FC-150, G.V.W. 5,000 lbs., is powered by the economical engine that made 'Jeep' vehicles famous. It combines with a new 16-gallon gas tank to let you cruise up to 300 miles on one filling. See your 'Jeep' dealer for a demonstration!

There's a 4-Wheel-Drive 'Jeep' vehicle for your job!



Universal 'Jeep'



'Jeep' Truck



'Jeep' Utility Wagon

'Jeep' Forward Control
4-Wheel-Drive **FC-150**

WILLYS... world's largest makers of 4-Wheel-Drive vehicles

WILLYS MOTORS, INC., TOLEDO 1, OHIO

To order these helpful booklets check the reply card opposite page 68.

Valuable Traffic Control Manual

676. ReflectORIZED everlasting flexible plastic that is available in various sizes, shapes and strips is described in manual available from Economarker Safety Corp., 1820 Central Parkway, Cincinnati 14, Ohio. Prefabricated legends, numerals and directional arrows are types included. Check the reply card.

Post Hole Digger With Interchangeable Heads

677. Post hole digger for installing guard rail, sign and similar posts is described in literature from Roper Mfg. Co., Zanesville, Ohio. The digger is equipped with a series of interchangeable heads for a wide range of uses from penetrating soft earth to permafrost shale and coral rock. Check the reply card today.

Clean Sewers With the O'Brien Sewerking

678. The O'Brien Sewerking operates completely by power in cleaning sewers and for full information write O'Brien Mfg. Corp., 5662 Northwest Highway, Chicago 30, Ill. Check the reply card to find out how power rotates cable and cutting tool and how power transmission drives cable forward or reverse.

Catalogs on Diesel, Dual-Fuel, Natural and Sewerage Gas Engines

679. Heavy duty diesel, dual-fuel, natural and sewerage gas engines for continuous stationary service are described in literature available from Chicago Pneumatic Tool Co., 8 East 44th St., New York 17, N. Y. Check the reply card for details on 3, 5, 7 and 8 cylinder models and in capacities from 120 to 3000 hp.

Blast Generators For Cleaning Bridges and Water Towers

680. Ruemelin blast generators are used for cleaning steel work to remove rust, paint and scale before painting and are also used to remove laitance from cement wherever concrete construction is in progress. For full details write Ruemelin Mfg. Co., 3900 N. Palmer St., Milwaukee 12, Wisc., or check the reply card.

Cast Iron Fittings For All Types of Water Pipe

681. Short body and mechanical joint water-main fittings—2" through 12", standard bell spigot fittings—2" through 36", ring-tite fittings—3" through 12" and fluid-tite fittings—3" through 12" are covered in literature from Trinity Valley Iron and Steel Co., P. O. Box 664, Forth Worth, Texas. Check the reply card.

Information on Photogrammetric Engineering

682. Find out how aerial surveys will advance starting time of construction jobs, conserve engineering manpower, produce fast but factual data and is economical but exact. Check the reply card or write Air Survey Corp., 1101 Lee Highway, Arlington 9, Va. today for complete information.

Sand, Chip and Calcium Chloride Spreader For Ice Control

683. Complete specifications, performance records and prices on the Fox sand spreader are covered in literature from Fox River Tractor Co., Dept. R3, P. O. Box 469, Appleton, Wisc. Spreader can be attached or removed from most any dump truck in 15 minutes and can be operated from 5 to 40 miles per hour. Check the reply card.

Sweepers Handle A Variety of Jobs In Every Season

684. Mechanical drive one-way and pull type 2-way sweepers and hydraulic 2-way sweepers that are tractor-mounted or loader-mounted are fully covered in literature from M-B Corp., 1611 Wisconsin Ave., New Holstein, Wisc. Jobs like cleaning dust, dirt and snow from streets and highways and sweeping park lawns are a few of the sweepers applications. Check the reply card.

How To Use System Head Curves

685. A 4-page bulletin for your help in proper pump selection is available from Peerless Pump Div., Food Machinery and Chemical Corp., 2005 Northwestern Ave., Indianapolis 8, Ind. Check the reply card for the information you need to avoid some of the

pitfalls in pump application, by using system head curves in conjunction with pump performance curves.

Corporation and Curb Stops

686. Literature that illustrates and describes corporation and curb stops, copper service pipe couplings, lead and copper goosenecks and service boxes and accessories is available from A. Y. McDonald Mfg. Co., Dubuque, Ia. Sizes range from 1/2" to 2". Check the reply card.

Submersible Pump For All Municipal Water Needs

687. A complete line of submersible pumps for wells as small as 4"; lifts from 30 to 10,000 ft.; capacities of 5 to over 1000 gpm is described fully in Bulletin R-432 from Recla Pump Co., Bartlesville, Okla. Check the reply card for information on these pumps.

Trencher For Ford and Ferguson Tractors

688. The mobile tractor mounted trencher digs clean trenches up to 5 feet deep and as fast as 300 feet per hour. Check the reply card for literature on models and specifications or write Earth Equipment Corp., 2036 Sacramento St., Los Angeles 21, Calif.

WATER WORKS

Engineering Information and Water Distribution Products

49. Helpful engineering information, covering water distribution problems, is available from Mueller Company in their W-96 Water Works Catalog. The 328 page catalog features a quick reference sectional indexing arrangement for easy location and identification of the hundreds of water distribution and service products illustrated. Check the reply card and you will receive detailed information on a complete line of water works equipment.

Let us show you how to cut mowing costs



(Photo by The Davey Tree Expert Company)

Accurate records over a three-year period showed that weed and brush control along highways costs better than \$100 a mile when mowing was the basic control method.

Comparative tests over the same period proved that a combination of chemical control with fewer mowings did a better job at far less cost. Moreover, chemicals could be applied the full width of the right of way—30 feet or more back from the roadway.

As one of the world's largest makers of herbicides, DIAMOND has the experience and technical facilities to help you map out a reliable chemical control program that avoids pitfalls. Why not contact us and let us show you how to cut highway maintenance costs? Just write DIAMOND ALKALI COMPANY, 300 Union Commerce Bldg., Cleveland 14, Ohio.



Diamond Chemicals

OLIVER

SUPER 55



Save money all over town with the new 58 Loader...and Jet-Trencher

This versatile Super 55 is an outstanding money saver on all kinds of municipal work such as digging, dozing, loading, grading and cleanup assignments.

Now, with the new 58 Loader it's a better buy than ever before. Big 11-cu. ft. bucket has full roll-back action and 3800-lb. breakaway power for bigger production and full loads at every pass. New higher clearance of 10' 10" makes truck-loading easier and faster. Full hydraulic operation is so simple the average operator becomes expert in a matter of hours.

You'll keep the Super 55 busy the year 'round on street and service line work, handling stock pile materials, snow removal and scores of other jobs. Full range of attachments includes dozer blade, scraper, scoop, fork lift, mowers, wood saw and a dozen more.

See your Oliver construction machinery distributor for full details. Or write us for literature.



With **JET-TRENCHER** the Super 55 becomes a double-ended money saver. Its fast-working $\frac{3}{4}$ -yd. bucket digs up to 11 ft. deep, dumps to either side with a full 180° swing. Hydraulic operation is smooth, powerful, safe. With simple 2-point hitch, the Jet-Trencher can be attached or removed in only 3 minutes.

THE OLIVER CORPORATION

400 West Madison Street, Chicago 6, Illinois



A COMPLETE LINE OF INDUSTRIAL WHEEL AND CRAWLER TRACTORS AND MATCHED ALLIED EQUIPMENT

PUBLIC WORKS for May, 1957

To order these helpful booklets check the reply card opposite page 68.

Ball and Socket River Crossing Cast Iron Pipe

33. Literature is available describing Clow ball and socket cast iron pipe for river crossing, or any installation where full 15 degree free turning deflection is desirable. For full description and specifications, address James B. Clow & Sons, Inc., P. O. Box 6600-A, Chicago 80, Ill., or check the reply card.

Discussion of Ranney Method For Municipal Water Production

116. A very interesting study of municipal and industrial water supply problems and a complete discussion of Ranney Collectors for water production will be found in a 20-page booklet published by Ranney Method Water Supplies, Inc., Box 5415, Shepard Station, Columbus 19, Ohio. Water quality, construction methods, costs, performance and other topics are considered. Check the reply card to get your copy.

Meter Features That Help Make Water Works Profitable

59. Simple design, accuracy and long life, moderate first cost and inexpensive maintenance are features of American Water meters described in Bulletin No. 56 of the Buffalo Meter Co., 2917 Main St., Buffalo 14, N. Y. Be sure you have this informative booklet which gives the details of American meter design and construction plus full data on sizes, capacities and dimensions. Check the reply card.

Convenient Reference Manual Covers Cast Iron Pipe, Valves and Hydrants

76. An 80-page manual, issued by R. D. Wood Co., Independence Sq., Philadelphia 5, Pa., presents specifications for "Sand-Spun" cast iron pipe and fittings, outlines types of joints available, lists dimensions and weights in convenient tables and includes, in addition, full engineering data on the Mathews fire hydrant and R. D. Wood gate valves.

Save Space By Filming Your Records

57. Microfilm your records by using the Recordak Microfilmer. Check the reply card or write Recordak Corp., 415 Madison Ave., New York 17, N. Y., for operation, use and price of this machine. Also available is literature on the Recordak Verifax Copier that makes certified copies 15 times faster than typing.

100 Page Book Helps Solve Water Problems

71. pH and Chlorine Control. A discussion of pH control and description of comparators, colorimeters and similar devices. A 100-page booklet is available by checking reply card W. T. Taylor Co., 7304 York Road, Baltimore 4, Md.

Rapid Sand and Pressure Filter Data

109. Rapid sand filters. A complete line of vertical and horizontal pressure filters, wooden gravity filters, and filter tables and other equipment. For engineering data, write Roberts Filter Manufacturing Co., 640 Columbia Ave., Darby, Pa., or check the reply card.

Complete Catalog on Pipe Line Equipment

121. Listed under one comprehensive catalog No. 26 are a complete line of water, gas and sewer pipe line equipment. Some of the items covered are pipe cutters, diaphragm pumps, melting furnaces, caking tools, M-scope pipe finders and joint runners. Write to Joseph G. Pollard Co., Inc., New Hyde Park, N. Y., or circle the reply card for your copy.

Information on Service, Valve, Roadway and Meter Boxes

122. Literature on specifications covering "Buffalo" service, valve, roadway and meter boxes, and adjustable valve boxes for water and gas has just been released from Buffalo Pipe & Foundry Corp., Box 55-Station B, Buffalo 7, N. Y. Check the reply card for your information on these valve boxes.

Helpful Reference Catalog on Waterworks Gate Valves

146. All necessary details on Double Disc Parallel Seat Gate Valves for waterworks use are provided in the attractive 36-page bulletin issued by Ludlow Valve Mfg. Co., Inc., Troy, N. Y. Conveniently arranged design data shows all dimensions for 2" to 60" valves. Gearing, floor stands, operating devices are covered too. Get Bulletin 54W by checking the reply card.

Purification of Swimming Pool Water

153. An up-to-date 64-page manual on purification of swimming pool waters presents a comprehensive discussion of daily requirements, chlorine residuals and feeding methods for trichlorites and HTH tablets. Available from Industrial Chemicals Div., Olin Mathieson Chemical Corp., Baltimore 3, Md. by checking the reply card.

What You Should Know About Steel Reservoirs and Standpipes

163. In a handsome 24-page booklet "Horizontal Steel Reservoirs and Standpipes," the Chicago Bridge & Iron Co., Chicago 4, Ill., shows installation from 50,000-gal. to 10,000,000-gal. capacity with several types of roof and special architectural features. Engineering data includes information on capacities, foundations and improved surface protection. Check the reply card to get your copy.

Lay Water Mains Faster With 'Fluid-Tite' Couplings

184. Get permanent water-tight joints automatically with Century "Fluid-Tite" couplings for Century asbestos-cement pressure pipe. Full details on this faster installation and self-energizing couplings are available from Keashey Mattison Co., Ambler, Penna. or by checking the reply card.

Engineering Data on Tilting Disc Check Valves

196. The Chapman tilting disc check valve is designed to lift away from the body seat without sliding or wearing; closes without slamming. Operating principles, details of construction, dimensions, recommendations and engineering data are fully covered in 18-page Bulletin No. 30. Get your copy by checking the reply card or write to Chapman Valve Mfg. Co., Indian Orchard, Mass.

Mowers designed for municipal jobs added to farm-famous *Servis* line.

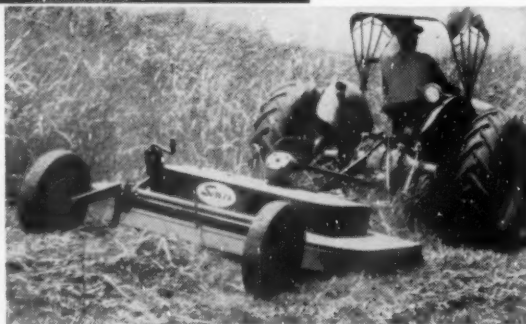


New

E-60. Finding its Gyro cutters sturdier than necessary for many jobs, Servis introduces this 60" gear-driven clipper. Light weight, yet guaranteed to cut tough, 1 1/2" brush. Pull and lift models. Sells for considerably less than the heavy Gyro models.

New

SC-80. Introduced to some territories late in '56, this new belt driven, twin-bladed, rotary mower cuts 1" brush — on an 80" swath. May be offset up to 32" outside rear tractor wheel. Very economical to operate.



New improvements in famous Gyro line:

Famous Gyro cutters, which shred brush up to 3" thick, now offer fan-type suction blades to lift stalks off ground. Also available, new ribbed rear skirt to raise

stalks back up into path of blades. Re-positioned stationary blade and a front guide plate are other improvements that give superior shredding.

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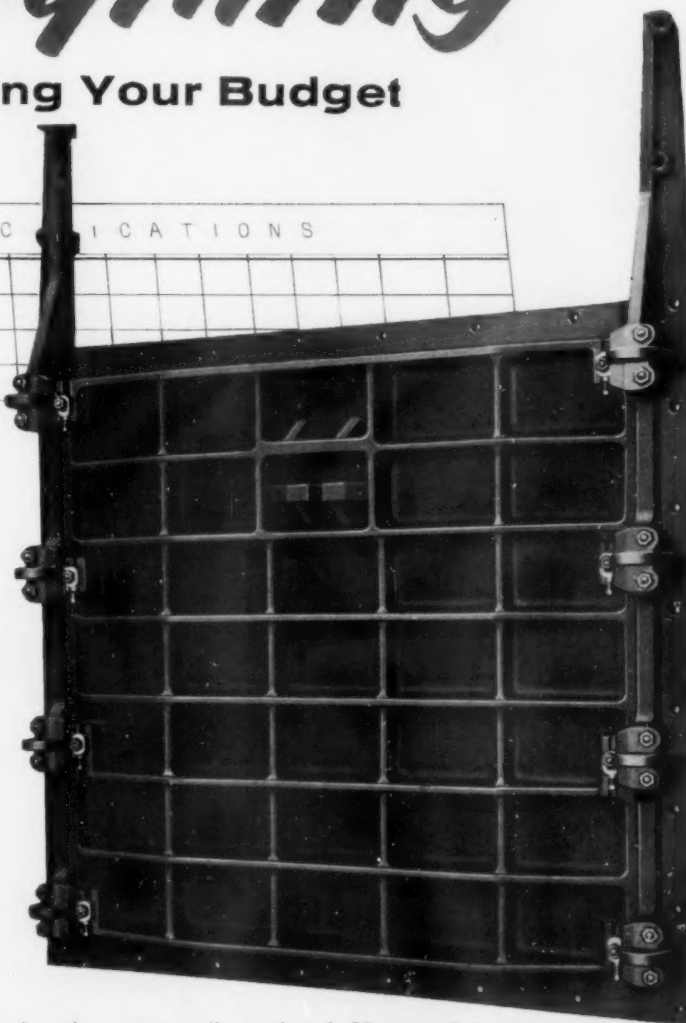
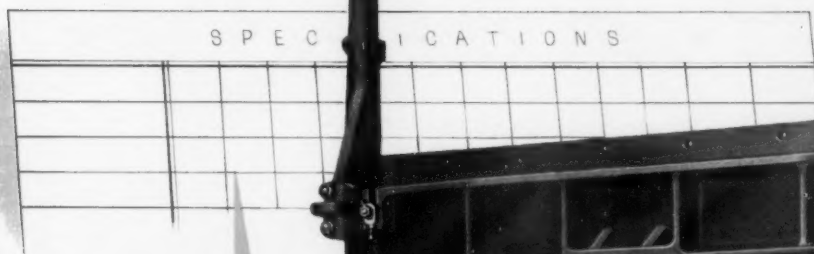
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... Including Your Budget

Chapman *Standard* Sluice Gates



No matter what your requirements are, installations, *in every case*, are easy with Chapman Standard Sluice Gates. The reasons are soon obvious.

All component parts . . . discs, guides, hooks and wedges . . . in more than 300 available types and sizes are standardized. That means they're interchangeable. Regardless of your specifications, you always get a quick perfect fit. There's nothing hit or miss about it. No expensive, time consuming match-marking. No extensive field alterations. You get a quick, perfect fit *at* lowest possible cost.

Even after installation, your savings never stop. These standardized, interchangeable parts

are easily replaced. Your maintenance cost for keeping your sluice gates in excellent working order is low, *the lowest possible*.

This applies to all Chapman Standard Sluice Gates . . . for high or low head, seating or unseating pressures, large or small water areas . . . with manual, hydraulic or electric motor operation. All available in the fastest possible time.

If you don't have a copy of our Catalog 25-A readily on hand, write for a new fresh copy.

**The CHAPMAN Valve
Manufacturing Co.**

INDIAN ORCHARD, MASSACHUSETTS

To order these helpful booklets check the reply card opposite page 68.

Bulletin on Submersible Booster Pump

201. Typical installations, description of unit, standard models, selection tables and the many jobs where this pump can be used are fully described in the bulletin. For full details write Layne & Bowler Pump Co., 2943 Vail Ave., Los Angeles 22, Calif., or check the handy reply card today.

Complete Information on Portable Electric Plants

202. New power-packed electric plants that are smaller and easier to move around are fully described in bulletin A-406 available from D. W. Ouan & Sons Inc., 3682 University Ave., S. E. Minneapolis 14, Minn. Applications, specifications and optional equipment are covered. Check the reply card.

What Should You Look For In a Power Sweeper?

206. Helpful information to aid you in the selection of a power sweeper to fit your needs is provided in Bulletin 85.2, issued by G. H. Tennant Co., 2530 N. Second St., Minneapolis 11, Minn. Full data on the highly maneuverable Tennant Model 75 Sweeper is included. Get your copy by checking the reply card.

Heavy Duty Air

Cooled Engines For Many Uses

223. Power and weight specifications, dimensions and uses are fully covered in literature issued by Wisconsin Motors Corp., Milwaukee 46, Wis., on their air-cooled engines. Also available is a service map and a list of their distributors and approved service stations. Check the reply card.

Helpful Valve Catalog For Engineers

236. For complete descriptions of Darling double disc, parallel seat gate valves be sure to get Bulletin 5403 issued by Darling Valve & Mfg. Co., Williamsport, Pa. Construction details covering all valve parts and accessories are helpful for specification writers. Check the reply card for your copy.

Efficient Underdrains for Rapid Sand Filters

239. Be sure you have engineering data on vitrified clay underdrains, efficiently designed for filtering and backwashing. Check the reply card or write F. B. Leopold Co., Inc., Dept. P.W., 227 So. Division St., Zelienople, Pa.

Water Lines Under Pavements Easily Installed

247. With a Trojan pipe pusher and puller no resetting of grip is required, so the work goes twice as fast. Two models, for pipe up to 2" dia. The larger model is available with air power unit to eliminate manual pushing. Get full details by checking the reply card. Trojan Mfg. Co., 1114 Race Dr., Troy, Ohio.

Quick Review of Water Meters

316. A helpful condensed catalog which covers sizes and types of water meters for every kind of service is available from Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh 8, Pa. Each type is illustrated and fully described; specifications and prices are included. Gen. Bulletin W-800 by checking the reply card.

Valuable Booklet on Porous Diffuser Plates and Tubes

341. A helpful 16-page booklet published by the Norton Co. is a complete guide for the selection of porous media for installation in rapid sand filters and activated sludge plants. Full data are provided for the consulting engineer. Maintenance of porous media is also discussed at some length. Get Form 1246 from Norton Co., Worcester 6, Mass. by checking the reply card.

Engineering Data on Equipment for Municipal Water Conditioning

347. For information on the design and operation of many types of water treatment plant equipment, including the Graver Reactivator, pressure filters, iron removal installations, zeolite softening and water conditioning for swimming pools get Bulletin WC-113 from Graver Water Conditioning Co., 216 West 14th St., New York 11, N. Y. Check the reply card.

Valuable Information On Prestressed Concrete Tanks

356. This helpful booklet describes the design uses and advantages of prestressed concrete in all types of storage tanks. Plenty of charts, diagrams and illustrations are included. Get yours from The Preload Company, 211 East 37th St., New York 16, N. Y., or check reply card.

All About

Centrifugal Pumps

361. Where pumping performance counts you want to check your specifications carefully. Investigate the features of Fairbanks-Morse centrifugals. Use reply card or write to Fairbanks, Morse & Co., Dept. P.W., Chicago 5, Ill.

How Your Filter Washing Can Be Improved

368. More effective sand washing with elimination of mud balls and bed cracking with resultant longer filter runs are claimed for the Palmer Filter Red Agitator, described in bulletins issued by Palmer Filter Equipment Co., Erie, Pa. Check the reply card.

Here's Help for

Laboratory Planning

369. A comprehensive laboratory planning guide that tells the engineer and designer how to obtain maximum space economy; utilize new and present facilities; and use functional design in locating utilities, ventilation and lighting is now available from Metalab Equipment Co., Hicksville, L. I., N. Y. Complete data includes sectional and interchangeable lab equipment, furniture and accessories. Check the reply card for this valuable planning aid.

Swimming

Pool Data Book

373. A 52-page book, profusely illustrated, containing data, photographs and prices of every item needed to build a new residential or public pool, or to equip and maintain an existing pool is now available. There is a section on proper pool care and maintenance and detailed descriptions of approved water treatment chemicals. Book is available by checking the reply card or writing to Modern Swimming Pool Co., Inc., 1 Holland Ave., White Plains, New York.

NEW!

OK CHAMPION POWER SEWER CLEANER

Model C8-23R6 — NOW READY!

Safety features for operators and sewer line not found on any former model.

Automatic return to neutral position even when power control is left unattended — belt slippage for overload.

Folding arch double pinned to allow lowering to either side or removal.

Extra heavy H beam and double steel channel construction. Overall length only 74 inches. Interchange overnight cable drum from one machine to the other of the pair.

Simplicity of operation.

Two speeds — change from high to low in seconds — eliminates buying transmission.

Rack and pinion jack legs on front and rear end for quick and easy machine leveling and towing.

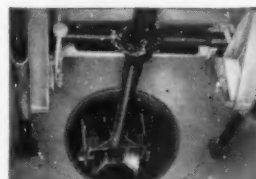
Operator removed from traffic and moving mechanisms hazards.

Novel belt and gear power transfer from engine to cable drum.

Giant in pulling power.



40 Years
Experience
designing and
manufacturing
sewer cleaning
equipment
utilized in this
new model.



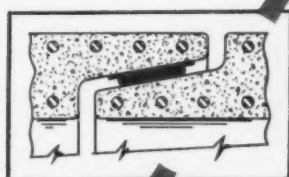
Pole suspended
guide wheel
mounting allows
virtually 360°
positioning choice
and transporting
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from machine.

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Specifies **LEAK-PROOF**
NON-DETERIORATING
TYLOX
RUBBER
PIPE JOINTS



TYPE "A" GASKET
under full
compression

PROJECT — Richfield-Edina Trunk Sewers.

PIPE — 54" diameter reinforced concrete. Furnished by Twin City Concrete Pipe Co., Minneapolis, Minn.

ENGINEERS — For City of Minneapolis: Hugo G. Erickson, City Engineer. W. A. Ostrem, City Sewer Engineer.

CONTRACTOR — City of Minneapolis Engineering Department.

**THE ONLY PERMANENTLY TIGHT LINES
ARE LAID WITH TYLOX RUBBER GASKETS**

PUBLIC WORKS for May, 1957

TYLOX

- ★ PREVENTS INFILTRATION
 - ★ DEFEATS CORROSION
 - ★ REDUCES COST
- OF NEW TRUNK SEWERS**

Minneapolis city engineers and officials made sure taxpayers would get the most for their waste disposal dollars now, and in the future, when they designed the Richfield-Edina trunk sewer. One instance of wise planning was their choice of gaskets for coupling the large concrete sewer pipe. By specifying TYLOX Rubber Joints, they put the project ahead in three important ways.

MORE PIPE LAID PER DAY — Tylox eliminates "wet trench" delays . . . permits immediate backfilling . . . reduces job costs by cutting down man hours.

NO JOINT FAILURES — Flexible TYLOX compensates for angularities in the line . . . soil stresses or surface loads won't break the compression-tight, infiltration-proof seal.

NO CORROSION — TYLOX is virtually ageless. Sewage and industrial waste acids and alkalis can't harm it. Under ground and under compression, it outlasts the pipe itself.

Specify TYLOX, and make sure of fast-working, leak-proof, corrosion-proof joints on all your sewerage, drainage and non-pressure water lines. Write for more details and illustrated case histories today.

HAMILTON KENT
MANUFACTURING COMPANY

KENT, OHIO

427 West Grant St.

Orchard 3-9555

To order these helpful booklets check the reply card opposite page 68.

How to Clean and Develop Water Wells

375. The use of Welfone, which combines the cleaning power of Calgon with disinfecting and other chemicals in a safe, highly soluble powder is described in an interesting and informative booklet. For your copy of this descriptive literature write Calgon, Inc., Hagan Bld., Pittsburgh 30, Pa. or check the reply card.

Roll-On Joint Pipe

For Water, Sewage or Other Liquids

388. American Roll-on Joint Pipe that is centrifugally cast in sand-lined molds for water, sewage or other liquids is described completely in catalog just released by American Cast Iron Pipe Co., Birmingham, Alabama. Applications, specifications, design, class, assembly and disassembly are included. Check the reply card.

What You Should Know About

Meter Setting and Testing Equipment

413. Complete details on all equipment and proper methods for meter testing and installation are included in an excellent book published by Ford Meter Box Co., Wabash, Ind. All water works men concerned with setting and testing meters will want a copy of this catalog, No. 56. Check the reply card for your copy.

How to Choose the Right

Self-Priming Centrifugal Pump

427. Descriptive folders on the complete line of contractors' pumps have been issued by the Gorman-Rupp Co., Mansfield, Ohio. 2-in. to 10-in. models are illustrated, performance tables are shown and pump selection tables are included to assist in choosing the proper pump for different jobs. Check reply card for your copies.

Engineering Data on Micro-straining for Clarification of Water Supplies

443. Micro-straining by use of specially woven metallic fabrics clarifies liquids by removal of microscopic-sized suspended solids. A complete discussion of this process and its applications is covered in a 24-page "Micro-Straining Plant" booklet of Glenfield & Kennedy, Inc., 677 Fifth Ave., New York 22, N. Y. Check the reply card for your copy.

How to Eliminate Seepage On Construction Projects

472. Labyrinth waterstops are easily installed to provide the answer to the seepage problem and simply form work on all types of construction jobs. Investigate their use for water and sewage plants, reservoirs, swimming pools, etc. For full data check the coupon or write to Water Seals, Inc., 9 So. Clinton St., Chicago 6, Ill.

Modern Water Storage in Elevated Steel Tanks

511. A new edition of a catalog on modern water storage in elevated steel tanks has been published by Pittsburgh-Des Moines Steel Co., Neville Island, Pittsburgh 25, Pa. The 20-page bulletin includes dimensional data and capacities for six basic PDM tank types, in addition to many installation pictures and descriptions. Check the reply card today for your copy of this valuable catalog.

Air Control Valves For All Types of Pipelines

620. Literature on air valves, air and vacuum valves and pressure air valves is available from Multiplex Mfg. Co., Dept. C, Berwick, Pa. Check the reply card for complete information on air valves that keep your pipelines open for safe, economical operation.

Slide Rule For

Chemical Feed Calculations

627. A very handy chemical feed calculator is available from Industrial Chemical Sales Division, West Virginia Pulp and Paper Co., 230 Park Ave., New York 17, N. Y. Pounds per million gallons, grains per gallon and grains per gallon of CaO from lime are several of the calculations that can be made. Check the reply card today.

Equipment for Cleaning Water Mains

648. Twelve-page Catalog 55-B describes methods for cleaning water mains and gives details of power drives and tools for hydraulic and mechanical cleaning operations. Flexible Inc., 3786 Durango Ave., Los Angeles 34, Calif.

SEWERAGE AND WASTE TREATMENT

What You Should Know About Tricking Filter Underdrains

20. Specifications for vitrified clay under drain blocks conforming to ASTM standards, suggestions for layouts and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Tricking Filter Floor Institute c/o Editor, Public Works, 200 So. Broad St., Ridgewood, N. J. Check the reply card and we will forward your request.

How to Make Better Sewer Pipe Joints

37. How to make a better sewer pipe joint of cement—tight, minimizing root intrusion, better alignment of joint. Permits making joints in water-bearing trenches. General instructions issued by L. A. Weston Co., Dept. F.W., Adams, Mass. Check the reply card.

Engineering Data on Screening Equipment

77. Water, sewage and industrial waste screening equipment is fully described in a 28-page book, No. 2587, offered by Link-Belt Co., Dept. 137, Colmar, Pa. Complete data for the engineer and tables to determine the proper size unit for handling various capacities are included. This valuable, comprehensive booklet may be obtained by checking the reply card.

Theory of Controlled Digestion With Floating Cover Tanks

88. In an excellent 40-page booklet, an authoritative discussion of digestion theory and practices, including design, operation and economics is presented by the Pacific Flush Tank Co., Chicago 13, Ill. Complete data are given on the use of floating covers, together with details on tank construction, piping and control chambers. Requests for this valuable booklet to be made on business letterhead.

BARCELONA, SPAIN Also Cleans Its WATER MAINS With "Flexibles"

Without prior experience, the water department of Barcelona cleaned its mains with "Flexible" Power Rodding Equipment, guided only by the instructions in our manual. The lines had been practically useless, but were quickly restored to full service... to the great satisfaction of all concerned.

Proven tools and equipment are available for removing all types of deposits. For further details—

Send for Catalog 55-B and
our Water Main Cleaning Manual.



Flexible INC.

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(Distributors in Principal Cities)

AMERICA'S LARGEST LINE OF PIPE CLEANING TOOLS AND EQUIPMENT

"CLEAN LIVING" GIVES A CHEVY ENGINE LONGER LIFE!

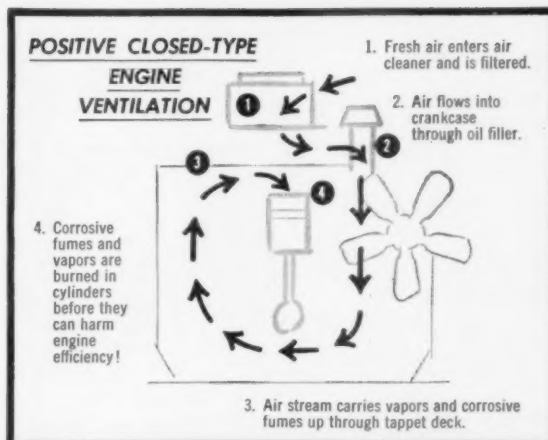
... more evidence that Chevrolet Task-Force trucks are engineered better and built better for bigger savings!

This drawing shows, roughly, one of the ways in which Chevrolet truck engines minimize a major cause of wear—dirt! Now consider this additional evidence that Chevy heavy-duty V8's and 6's "live clean" and bring you fleet, dependable power that costs less to use!

Extra filters give extra-clean fuel—Only clean fuel reaches the engine—that's one reason you can depend on a Chevrolet truck! All fuel is filtered twice (once in the fuel tank and again in the carburetor) to keep dirt and water from hampering efficient operation. Chevrolet truck V8's provide a third filter, at the carburetor, for triple protection!

Oil stays clean longer, too—Chevrolet truck V8's and 261-cu.-in. 6's come equipped with modern high-capacity oil filters (V8 filters are of the Full-Flow type). These engines keep clean oil flowing to moving parts; parts wear less and last longer because of it!

Even the air is cleaner—Dust and foreign matter in the



air an engine "breathes" can reduce engine life by years. Chevrolet minimizes this wear-producing factor by providing big oil-bath air cleaners as *standard equipment* on all truck engines.

These are sound under-the-hood reasons why a Chevrolet truck will *stay* on your job and *save* on your job. There are others, too, including short-stroke V8 design (shortest stroke of any truck V8's!) and 6-cylinder engine design that puts out more power than any other in the field. You'll learn about them all when you visit your Chevrolet dealer. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.



Biggest sellers . . . because they're biggest savers!

CHEVROLET TASK•FORCE 57 TRUCKS

To order these helpful booklets check the reply card opposite page 68.

Non-Clogging Vertical Wet-Pit Pump Described

182. Full engineering data on Worthington "Freeflow" wet-pit pumps with non-clogging impellers capable of passing solids and stringy material are included in Bulletin W-317 B-12. Check these pumps for sump, sewage and drainage service. Bulletin available from Worthington Corp., Harrison, N. J. Just use the reply card.

Reduce Labor Costs With Power Sewer Cleaners

189. A complete line of sewer cleaning equipment, including labor saving power units and all types of buckets, cables, rods and flushing equipment are listed in catalog of the Turbine Sewer Machine Co., Division of Chas. H. Stehling Co., 1303 N. Fourth St., Milwaukee 12, Wis. Check the reply card for your copy.

Pneumatic Transmission System

217. A colorful 8-page booklet, Bulletin 750, has been prepared by the Simplex Valve & Meter Co., Lancaster, Pa., describing the Laminair, a form of pneumatic transmission. The unit provides a sensitive and accurate type of instrumentation. Check the reply card.

How and Where to Install A Septic Tank System

270. A manual on modern sewage disposal methods for individual dwellings, camps and rural schools has been released by Brown Co., 150 Causeway St., Boston, Mass. Location, size of and building the tank, how large a disposal field and laying out the field are discussed. Check the reply card today.

How to Dispose of Sewage and Industrial Sludges

281. Get full information on the C. E. Raymond System of combined incineration and sludge drying providing high temperature deodorizing for nuisance-free sludge disposal. Flexible layouts fit large and small communities. Use handy reply card or write Combustion Engineering Inc., Raymond Div., 1315 No. Branch St., Chicago, Illinois.

Valuable Catalog on Underground Pumping Stations

142. Factory-built underground pumping station with duplex sewage pumps is described fully in catalog just released by Smith & Lovell, Inc., 3427 Broadway, Kansas City, Mo. Information on operating conditions, design of sewage pump stations and force mains, charts and graphs and drawings are included. Also, full details are given on the pneumatic sewage ejector lift station which gives lower first cost, easier maintenance and greater dependability. Get all the facts by checking the reply card today.

Complete Story of Rubber as a Coupling Medium in Pipelines

295. "Joint Enterprise", a booklet describing Tylox rubber joints for coupling pipe used in sewerage, drainage and waterworks projects is now available from Hamilton Kent Manufacturing Co., 7 West Grant St., Kent, Ohio. The booklet also contains illustrated case histories of Tylox-jointed installations, and suggestions to assist engineer in specifying Tylox joints for both tongue and groove, and bell and spigot pipe. Check the reply card.

Use The Reply Card

Modern Methods and Materials For Joining Sewer Pipe

402. In a compilation of reprints and related supplementary material, the Atlas Mineral Products Co., Mertzown, Pa., presents a comprehensive review of all types of sewer jointing materials and methods. You will find this interesting and informative reading. Get a copy by checking the reply card.

Champion Power Sewer Cleaners

619. Literature from Champion Corp., 4718 Sheffield Ave., Hammond, Ind. describes the Model C8-23R6 power sewer cleaner. Features include simplicity of operation, folding arch double pinned to allow lowering to either side or removal, safety features for operators and two speeds. Check the reply card.

A Precast Concrete Filter Bottom

394. The Criscrete unit is precast prestressed concrete built monolithically spanning the entire width of the filter in one piece. It requires 6 in. overall depth in the filter and employs non ferrous nozzle liners. For complete information on this filter unit get literature available from MCG Co., 1771 W. 5th Ave., Columbus 12, Ohio, by checking the reply card.

Solids Pump Uses Recessed Impeller

428. The Wemco "Torque-Flow" solids pump works with a completely recessed impeller which creates a vortex effect and transmits power exactly as in a fluid type torque converter. This avoids flow through impeller vanes and reduces clogging difficulties when handling sewage sludge or abrasive materials. For full details get Bulletin P10-B6 by writing to Western Machinery Co., 650 Fifth St., San Francisco 7, Calif., or check the reply card.

Trickling Filter Systems For Small Sewage Plants

506. Trickling filter systems for the small sewage treatment plant, such as required for isolated, institutional, industrial and residential developments, are detailed in a 24-page manual available from Yeomans Brothers Co., 2000-1 North Ruby St., Melrose Park, Ill. In addition to the trickling filter distributors the catalog also gives specifications and suggested sizes for the Spiragster. Check the reply card for Manual 6769.

V-Notch Chlorinators For Water and Sewage Plants

590. Bulletins on the Series A-711 and the Series A-712 chlorinators are available from Wallace & Tiernan Inc., Box 178, Newark, N. J. Covered in the literature are design features that include operation, installation and maintenance. Simplified flow diagrams in color are included showing the operation of the units. Class, capacities, feed ranges and electrical requirements are described in the technical data section. For your copies, check the reply card.

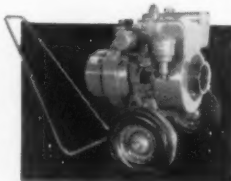
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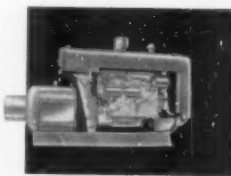
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() Please send literature, specifications, prices on Universal Electric Plants for municipality services.

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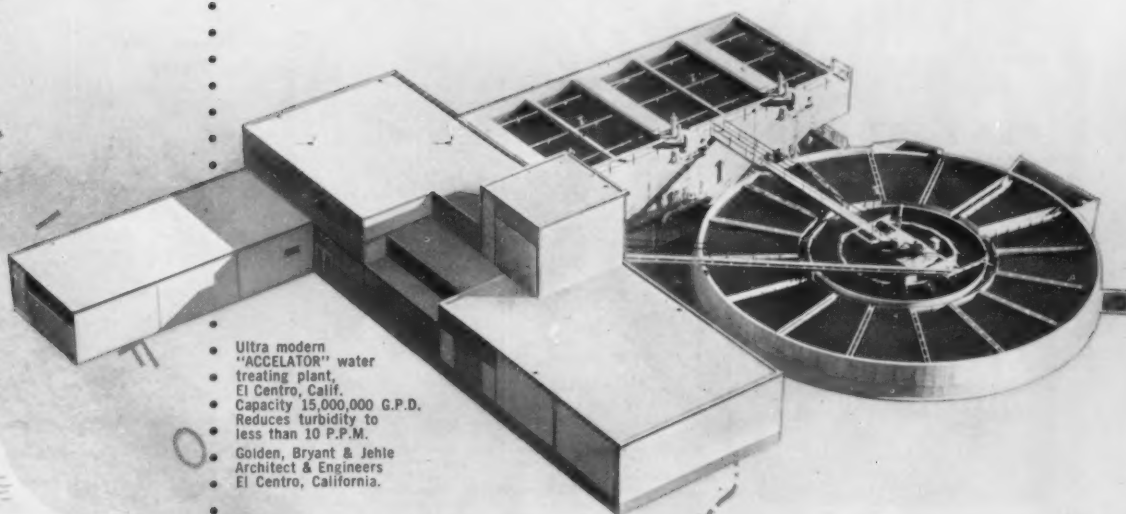
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487. American Pipe Cleaning Co. cleans
sanitary sewers and water mains for municipal-
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let Ave., Minneapolis, Minn., or check the
reply card for information on this pipe clean-
ing company.

Press-Seal Rubber Gaskets to

Seal Joints of Concrete Pipe Sewers

623. Rubber gaskets for sealing the joints
of concrete sewer pipe are described fully in
literature available from Press-Seal Corp.,
P. O. Box 482, Fort Wayne, Ind. Check the
reply card for information on how these gaskets
prevent water infiltration in sewer lines.

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For Holmes-Owen Loader

39. The addition of a Holmes-Owen Load-
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plete digging and loading unit that enables one
man to load, haul and dump. Illustrated folder
shows how this self-loading unit with hydraulic
crowding action can be a real time and labor
saver for the municipality or contractor. Check
the handy reply card for full data. Ernest
Holmes Co., Chattanooga, Tenn.

One-Piece

Traffic Letter Mats

63. Brightly colored, flexible plastic, re-
flective traffic letter mats are described in
literature released by J. W. Neff Laboratories,
Inc., Stockertown 1, Pa. Check the reply card
for information on how these mats are placed
on the streets and highways and where they can
be used.

How to Save Time on

Curb and Gutter Work

143. Every type of curb and gutter work
is illustrated in the 12-page Helzel catalog on
steel forms for building concrete curbs, gutters
and sidewalks. Time-saving setups show how
to speed up the job and save money. Get your
copy from Helzel Steel Form & Iron Co., Dept.
PW, Warren, Ohio. Use the reply card to get
your copy.

Literature on the Four-

Wheel Drive Jeep Truck

144. The FC-150, "Forward Control" Jeep
truck is described fully in literature available
from Willys Motors, Inc., Toledo 1, Ohio. A
few engineering features are 81-inch wheelbase,
18-ft. turning radius, 9 forward and 3 reverse
power combinations and four-wheel drive. For
complete specifications check the reply card.

Literature on Galion

Roll-O-Matic 3-Wheel Roller

187. A highly illustrated catalog is now
available on the new Galion "Chief" 3-wheel
roller. All important features of design and
construction are presented in detail. Detailed
weight distribution and compression data on the
various sizes of rollers are listed along with a
complete line of attachments. Check the reply
card or write Galion Iron Works & Mfg. Co.,
Galion, Ohio.

"A Complete Package" of Road Building Equipment

261. A new catalog describing the road
widener, trench roller and base paver has been
released by Blaw-Knox Co., Construction Equip-
ment Division, Pittsburgh 38, Pa. Illustrations,
specifications and operation procedures are fully
covered. Check the reply card today.

Disposal of Brush and Tree Limbs a Problem? Here's your answer.

222. A new booklet, "The Modern Ap-
proach to the Brush Problem," shows how an
Asplundh chipper reduces bulky branches and
brush trimmings to chip size for mulch or easy
removal. Write Asplundh Chipper Company,
505 York Road, Jenkintown, Pa., or use the
handy reply card.

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180. Vibratory compactors offer the means
for getting specified density in rock, slag, soil-
bound macadam, gravel and sand base courses.
Just one pass may suffice. Get complete infor-
mation from Jackson Vibrators, Inc., Luding-
ton, Mich. See how adaptable compactor units
handle a variety of compaction needs. Check
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Eaton 2-Speed Axles

For Your Trucks

264. Truck axles that provide easy shift,
supply positive lubrication and have a self-
contained air brake are available from Eaton
Mfg. Co. For complete information on these
rugged axles check the reply card or write
Eaton Mfg. Co., Cleveland, Ohio.

How to Solve the

Brush Disposal Problem

277. Fitchburg Chippers, engineered to
solve the brush disposal problem reduce
troublesome brush and trimmings to tiny, easy-
to-dispose-of chips. Several models are avail-
able to meet your needs. May be mounted on
truck body or on trailer, tractor or jeep. Full
details in interesting, profusely illustrated 16
page bulletin. Write Fitchburg Engineering
Corp., Fitchburg, Mass., or check the reply
card for your copy.

Complete Information

on Wain-Roy Back Hoe

459. Complete information on a self-con-
tained back hoe that is designed to fit Pay-
loader tractor-shovels and International crawler
and wheel tractors is available from Wain-Roy
Corp., Dept. C, Hubbardston, Mass. Included
are specifications, types and many exclusive fea-
tures. Check the reply card today.

Information on 5 Versatile Tractors

For Municipal and County Work

484. Tractors that find scores of highly
efficient applications in construction, munic-
ipalities, utilities and related fields are de-
scribed fully in a catalog just released by
Massey-Harris-Ferguson, Inc., Industrial Div.,
Quality Ave., Racine, Wisc. Models, speci-
fications, attachments and uses are covered.

All-Wheel Drive

Heavy Duty Trucks

485. International all-wheel drive heavy-
duty trucks for construction and maintenance
work are described fully in literature from
International Harvester Co., 180 No. Michigan
Ave., Chicago 1, Ill. Check the reply card for
models, gross vehicle weights and uses.

3-Way Ditcher-

Terracing Blades

488. Servis heavy duty and standard 3-
way ditcher-terracing blades with scarifier teeth,
grader wheels and end plates for conversion to
a leveling scraper are described in bulletin
available from Servis Equipment Co., 1000
Singleton Blvd., Dallas 21, Texas. Check the
reply card for specifications, design and appli-
cation.

Structural-Plate

Bridge Flooring

515. A 12-page catalog on USF structural-
plate bridge flooring includes a general descrip-
tion of the flooring, step-by-step installation
photographs, drawings of engineering details, de-
sign data and specifications. Check the reply
card or write United Steel Fabricators, Inc.,
Wooster, Ohio, for your copy.

ReflectORIZED White or

Yellow Crosswalk Markings

578. Crosswalk markings of Perma-Line,
the quick setting line that is easily applied,
trouble-free, economical, and which outlasts
paint 4 to 6 times, is described in literature
of the Veon Chemical Corporation, 22-09 Bridge
Plaza North, Long Island City 1, N.Y. Avail-
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Write today for descriptive literature. Greenlee Tool Co., 2045 Columbia Avenue, Rockford, Ill., U.S.A.

The Dilemma of Our Present Highway System

314. "Where Do We Go From Here?" is the title of a 16-page booklet produced by Caterpillar Tractor Company, Peoria, Illinois. Many highway problems are discussed in the interesting and informative booklet. Inadequate and obsolete highways, financing of free roads and toll roads, and whether to construct free roads or toll roads are a few of the topics. A section is devoted entirely to the story of modern highways from the planning stages through the construction stages to the finished roadways. Check the reply card for this booklet. Form 31398.

Literature on 1957 Chevrolet Utility and Maintenance Trucks

579. Light and medium duty 1957 Chevrolet trucks are described fully in literature available from Chevrolet Div. of General Motors, Detroit 2, Mich. New features include modern versions of Thriftmaster and Jobmaster 6's and the short-stroke Trademaster V8's and the 283 cu. in. Taskmaster V8's. Also optional features are the Hydra-Matic and Powermatic transmissions. Check the reply card.

Vacuum Cleaner and Leaf Collector For Cleaner Streets.

595. A unit is now available that can be mounted on a right-hand drive jeep or a pick-up truck for picking up gutter trash and leaves. Complete specifications, capacity, operation and installation procedures are covered in a bulletin available from Tarrant Mfg. Co., Saratoga Springs, N. Y., or can be obtained by checking the reply card.

Helpful Data on Distributors for Bituminous Materials

611. Pressure distributors featuring uniform pressure and temperature, accurate displacement pumping, convenient operation are described in literature of Standard Steel Works, North Kansas City, Mo.

For Prompt Service Use The Reply Card

Fifty Combinations of Matching Equipment For Case-Terra Trac Tractors

617. Dump loaders, angledozers, bulldozer blader, backhoes, mowers and scarifiers are several of the attachments available for the 40 to 100 hp Case-Terra Trac crawlers and industrial wheel tractors. For complete information on the attachments and tractors write J. I. Case Co., Racine, Wisc., or check the reply card.

Warn Lock-O-Matic Hubs Manual

618. Warn Hubs make 4-wheel drive more useful, because they make it into a "free-wheeling" 2-wheel drive, as well as a 4-wheel drive. The Lock-O-matic hubs reduce front end wear, engine load and gear whine. Check the reply card or write Warn Mfg. Co., Riverton Box 6064, Seattle 88, Wash.

Light Duty Trucks For Construction and Maintenance

628. Pickup and stake body trucks are fully described in literature from Ford Div., of Ford Motor Co., Dearborn, Mich. Pickups are available in 6 1/2, 8 and 9-ft. lengths. They come in standard colors and with either a 6 or V-8 engine. Rigid tailgate and steel corner posts add to the over-all body strength. The stake body trucks come in 6 1/2, 7 1/2 and 9-ft. lengths. These units also come in 6 or V-8 engines. Check the reply card for full information.

Booklets on Salt-Soil Stabilization

633. Five booklets entitled: general principles of salt-soil stabilization, plant mix and road mix procedures, crushed rock roads, stabilizing gravel roads and stabilizing shoulders are available from International Salt Co., Inc., Scranton, Pa. Check the reply card.

Construction Methods for Salt Stabilized Roads

609. A comprehensive booklet showing modern methods of salt stabilization is available from the Morton Salt Co., 120 So. LaSalle St., Chicago 3, Ill. Stabilized secondary roads, base courses and shoulders are discussed and all equipment and construction methods are covered. Just check the reply card for your copy.

CONSTRUCTION EQUIPMENT AND MATERIALS

Tractor-Shovels of Any Size and Bucket To Fit Your Need

21. Literature is available on 7 basic models of tractor-shovels that are gas or diesel powered, 44 to 165 hp., front, rear and all-wheel drive from Clark Equipment Co., Pipestone Rd., Benton Harbor 43, Mich. Check the reply card for information on 35 different buckets and attachments ranging from 6 cu. ft. to 5 cu. yds.

Information on The Ottawa Heavy-Duty Backhoe

25. Features of this backhoe are an automatic ejector bucket; two levers do four operations; and a powerful hydraulic system with mechanical linkage to provide more digging power. For complete details check the reply card or write Ottawa Steel Div., L. A. Young Spring & Wire Corp., Ottawa, Kans.

A Clamp That Fits Pipe Regardless of Irregularities

78. A clamp that can be used on either asbestos-cement or cast-iron pipe is described fully in a bulletin released by the Dresser Manufacturing Division, 69 Fisher Ave., Bradford, Pa. Complete instructions are given as to how the clamp is put on the pipe, along with a price list of the length and size of clamp desired. Just check the reply card.

Useful Attachments for "Payloador" Tractor Shovels

95. Increased versatility for Hough "Payloador" tractor shovels is made possible by the various attachments described in literature of the Frank G. Hough Co., 761 Seventh St., Libertyville, Ill. Illustrated and described are rotary "V" and trip-blade snow plows, hydraulic backhoe, back-filler blade, pickup sweeper, scarifier teeth, winches, etc. Check the reply card today and full details will be sent.

A Tractor-Air Compressor Unit

140. "Around the Clock, Around the World" is the title of an 8-page bulletin describing Le Roi's new 125 Tractair, a self-propelled compressor unit with flexible tractor power. Applications, uses, attachments and tools, design and specifications of the compressor and engine are listed. Write Le Roi Division of Westinghouse Air Brake Company, 1706 South 68, Milwaukee 14, Wisconsin, or check the reply card for your copy.

Handbook of Castings For All Public Works Construction

220. Every type of construction casting needed by engineers and contractors in the public works field will be found in a 136-page catalog issued by Neenah Foundry Co., Neenah, Wis. Detailed illustrations and complete tables of dimensions will help the designer and materials buyer. Get your copy of this valuable catalog by checking the reply card today.

Booklet Shows Design of Pre-Engineered Steel Buildings

271. Pre-engineered Butler steel buildings are available in every size, type and design to meet your building needs. In a helpful 16-page booklet you will find details on several basic designs and an unlimited variety of door, window and interior treatments; answers to your questions on construction and erection; and many illustrations of typical uses. Use the reply card or write to Butler Mfg. Co., Kansas City, Mo.

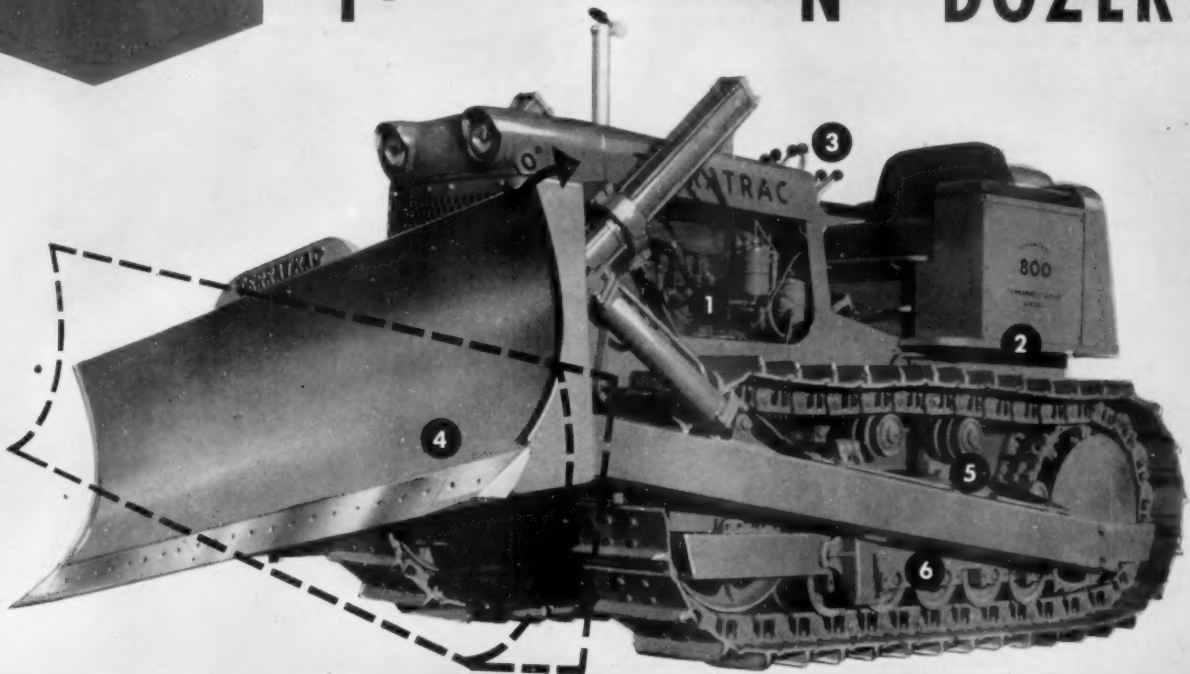
Davis Back-Hoe and Davis Loader

312. Literature is available from Mid-Western Industries, Inc., 1009 S. West St., Wichita, Kans., describing the new Davis backhoe and Davis loader. The back-hoe can dig at right angles and to a depth of 13 ft. and detaches in 5 minutes. Both units are available for most popular makes of tractors.

PUBLIC WORKS for May, 1957

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...revolutionary new CASE-TERRATRAC[®] "TILT-CROWN" DOZER!



Blade tilts and tips *hydraulically* from operator's seat

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And that's not all! This new torque-converter-equipped dozer also gives you *far more power, speed and ease of maneuverability* than any other crawler in its price range. New patent-applied-for counter-rotating transmission alone practically **DOUBLES** dozer output because it enables machine to make full 360° turns "in its own tracks"—*thus keep dozing in BOTH directions*, instead of backing up empty. See this sensational "Tilt-Crown" dozer now at your Case Industrial Dealer's, or:



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CT-D-15

SPECIAL FEATURES no other rig can claim

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- ⑤ Torsion-bar equalizers permit full track oscillation... keep blade level for smooth cuts.
- ⑥ Automatic track lubrication system cuts greasing interval from once a day to a few times a year.

J. I. CASE COMPANY, Dept. E1347, Racine, Wis., U.S.A.

☐ Send literature and prices on new Case-TerraTrac "Tilt-Crown" Dozer

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Address _____

City _____ State _____

Industrial wheel and crawler tractors • dozers • loaders • backhoes • fork lifts

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Catalog on Utility Bodies and Equipment

360. General service bodies, line construction bodies, aerial equipment, winch and derrick equipment and trailers are the units covered in this catalog. For design, dimensions, illustrations and descriptions check the reply card or write McCabe-Powers Auto Body Co., 5900 N. Broadway, St. Louis 15, Mo.

Power Shovel, Crane and Backhoe All in One Unit

441. A completely hydraulic backhoe, shovel loader and crane all in one unit is described in literature available from the Badger Machine Co., Winona, Minn. Also information on front-end loaders, truck and trailer mounted hydraulic backhoes and various attachments that are useful for contractors, municipal and county engineers and state highway engineers. Check the reply card.

Self-Propelled Ditching Machines

438. Information on a self-propelled one man operated ditching machine, model 524 T, and a new midget ditcher, model 4 T, for light construction is now available from the Vermeer Mfg. Co., Pella, Iowa. The Model 524 T digs 8 to 24 inches wide and down to 6 feet deep, while the model 4 T digs 6 to 14 inches wide and down to 4½ feet deep. Full data on these ditchers available by checking the reply card.

Convenient Data on Tandem and 3-Wheel Rollers

449. This manual covers everything on the variable weight, 5-8, 8-10, 8-12 and 10-14 ton tandem rollers and on the standard and variable weight, 8, 10, 12, 14 ton and 8-10, 10-12, 12-14 ton 3-wheel rollers. Covered are the frame, transmission, final drive, front end and operator's controls. The designs, construction, performance and service of the rollers are fully outlined. There are plenty of illustrations along with a complete set of specifications for each roller model. Available from Huber-Warco Co., Marion, Ohio, or check the reply card.

Concrete or Asphalt Saw

458. Concrete saws that sail right through concrete or asphalt are described fully in literature available from Clipper Manufacturing Co., 2804 S. Warwick, Kansas City 8, Mo. Also diamond and green-con blades are fully covered. Check the reply card.

IHC Crawler Tractors For Highway Construction

491. Information on the new International TD-6, TD-9, TD-14 and TD-18 diesel crawler tractors is contained in 8-page, 2-color booklets available from Consumer Relations Dept., International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill. Mechanical features and specifications, engine power, and operation are fully covered.

Joint Materials and Sealers Described in Latest Literature

492. Fibre material, asphalt board, cold pour joint sealer, crack fillers and concrete curing compound are described fully in literature available from Presstite-Keystone Engr. Products Co., 3906 Chouteau Ave., St. Louis 10, Mo. Check the reply card for information on these paving and building products.

Principles of "Batchomatic" Plants Explained

527. The unique principles of simultaneous and fully automatic aggregate and bitumen measuring followed on Barber-Greene's 2,000, 4,000 and 6,000 lb. "Batchomatic" bituminous batch plants are explained with cut away drawings, charts and other illustrations in a 3-color bulletin offered by Barber-Greene Co., Aurora, Ill. Check the reply card.

Paints For Bridges, Water Tanks & Other Metal Structures

624. Flake silica graphite paints for outdoor metals are described fully in literature from Paint Sales Div., Joseph Dixon Crucible Co., Jersey City 3, N. J. Check the reply card for details on these primer and protective paints.

Detailed Data and Prices on Optical Repeating Transits

583. Optical repeating transits are described fully in literature available from Wild Heerbrugg Instruments, Inc., Main at Covert St., Port Washington, N. Y. Check the reply card for information on design, operation and prices.

Attachments For Ford Tractors

643. Clearing, backfilling, ditching, excavating, mowing, scarifying, sweeping, and trenching equipment are a few of the attachments described in literature from Tractor and Implement Div., Ford Motor Co., 2500 East Maple Road, Birmingham, Mich.

WEED AND DUST CONTROL

Dust Control Made Easy

30. Details on an effective solution for your dust annoyance problems are presented in a colorful bulletin, "Gulf Sani-Soil-Set—the modern, proven agent for controlling dust." Get your copy to learn how this long-lasting, easily applied material can be of help. Write Gulf Oil Corp., 1822 Gulf Bldg., Pittsburgh 30, Pa. or check the reply card.

What You Should Know About Chemical Weed Control

283. General information on how and when to use Telvar, the chemical weed killer, is described in literature available from E. I. DuPont de Nemours & Co., Inc., Wilmington 98, Del. Application rate, type of weeds killed, type of equipment used for application are some of the sections covered. Check the reply card.



PROGRESSIVE CITIES SELECT



INCINERATOR STOKERS

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Designed and manufactured by a century-old concern with 40 years' experience in designing, engineering and completely manufacturing hydraulically-powered stokers.

"F&E" Hydraulically-Powered Stokers are the most talked-of incinerator advancement in the field today.

Should you wish to see an "F&E" Incinerator Stoker in operation and get firsthand information on their revolutionary performance, we will be pleased to advise where the installation nearest you is located.

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Armco HEL-COR Pile Shells provide foundation for new municipal building



Piling Contractor—Hercules Concrete Pile Company

Richmond County and the city of Augusta, Georgia, are jointly constructing a new municipal building to replace outdated office facilities. The structure (see architect's sketch above) will consist of a nine-story central building with two three-story courtroom wings.

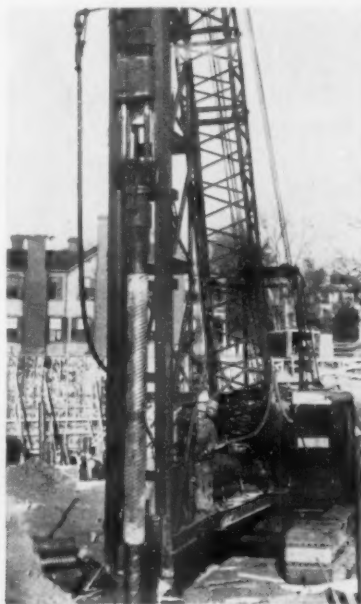
Soil borings indicated that much of the foundation material was not suitable for such a structure. To assure an adequate foundation, 691 Armco HEL-COR® Pile Shells were driven and filled with concrete. Pile Shells were 12¼-inch O.D., 18 gage steel with a metal boot welded on the penetrating end for driving. Although the soil borings showed ground water at the site,

the driven piles were devoid of water.

Many municipal officials have found Armco HEL-COR Pile Shells and Armco Pipe Piles are the efficient, economical answer to foundation problems. They have been used for foundations under new buildings, sewage and water treatment plants, bridges, and similar municipal structures.

Armco Pipe Piles and Pile Shells are available in a wide variety of diameters and wall thicknesses. Write for helpful information. Armco Drainage & Metal Products, Inc., Welded Pipe Sales Division, 4637 Curtis Street, Middletown, Ohio. Subsidiary of Armco Steel Corporation. Export: The Armco International Corporation.

HEL-COR Pile Shells were driven with a Vulcan #1 hammer, using a mechanical expanding mandrel that grips the inside of the shell.



Armco Foundation Pipe



To order these helpful booklets check the reply card opposite page 68.

STREET LIGHTING AND TRAFFIC CONTROL

Investigate These Street Lighting Standards

54. You can get complete data on Kerrigan factory-built "Weldforged" street lighting standards, brackets and mast arms by using the handy reply card. Check these strong, well designed, inexpensive steel standards for practical street and highway lighting. Handsome 26-page folder includes data sheets on floodlighting and area lighting applications. Kerrigan Iron Works, 1033 Herman St., Nashville, Tenn.

Information on Aluminum Lighting Equipment

296. Aluminum standards, brackets and lighting equipment are described fully in a catalog No. HAL-754 available from Hubbard Aluminum Products Co., Division of Hubbard and Co., Pittsburgh 1, Pa. Check the reply card today for information on poles designed for every outdoor lighting application.

A Guide to Effective Traffic Safety

468. A 20-page catalog with hundreds of illustrations of all types of signs used on highways and in motor and pedestrian traffic areas is offered to public works officials by Traffic and Street Sign Co., 84 Foundry St., Newark 5, N.J. This convenient reference covers all your sign needs.

Engineering Guide on Mercury Street Lighting

640. Technical data on mercury lamps applicable to general lighting service, operating characteristics of the mercury vapor lighting system and economic evaluation of lighting systems designed for equal lighting results are several of the sections covered in catalog from Westinghouse Electric Corp., Lighting Div., Edgewater Park, Cleveland, Ohio.

REFUSE COLLECTION AND DISPOSAL

How New, Larger Load-Packer Cuts Refuse Collection Costs

51. Ever increasing problems in refuse collection work include longer hauls and higher costs of labor, chassis, operation and maintenance. As a solution, Gar Wood offers Load-Packers with dual-thrust compaction that gives big capacity on shorter wheelbase, plus safe, labor-saving operation. Profusely illustrated Form W-144 tells why you should investigate Load-Packers. Check reply card or write Gar Wood Industries, Inc., Wayne, Mich.

For Prompt Service Use The Reply Card

Developments in Refuse Collection

119. The "Dempster-Dumpmaster" system for refuse collection combines the advantages of detachable containers for bulk collection, convenient front-end loading and compaction in a sealed body. Be sure to investigate the application of this system to your collection needs. Complete data offered by Dempster Bros., Knoxville 7, Tenn. Check the reply card today.

How to Construct A Sanitary Fill

331. A new 12-page booklet which tells the most efficient method of sanitary fill construction and furnishes complete information on planning and operation is now available from Drott Mfg. Corp., Milwaukee 15, Wis. Get your copy by checking the reply card; you'll find this booklet both interesting and valuable.

Actual Mechanical Operation of a Refuse Collection Body

387. The operation of the Collectomatic refuse collection body in printed form is available from The Heil Co., Milwaukee 1, Wis. This type of literature explains fully the operation of the mechanism and also gives the complete specifications and dimensions of these units. Check the reply card today.

Information on the Hydepak Refuse Packer

614. The Hydepak refuse packer is designed so that a lighter motor economical truck body can be used and the packer is available in 13, 16, 20 and 24 yd capacities. For complete specifications write Hyde Corp., P. O. Box 1265, Fort Worth, Tex., or check the reply card.

Data on Refuse Collection Bodies

615. The Hydro E-Z Pack compacting unit has only 2 working parts—a high volume roller bearing pump and a double-acting telescopic cylinder. A refuse-crushing compacting pressure of 82,500 lbs. is attained in the units. Write Hydro E-Z Pack Co., Galion, O., or check the reply card for complete specifications.

RECREATION

How to Equip Your Parks and Playgrounds

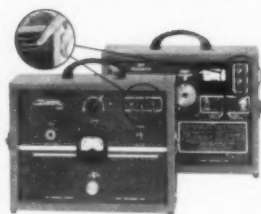
414. A handsome 60-page illustrated catalog showing a full line of extra heavy duty playground, pack-picnic and dressing room equipment, plus many related items, is now available from American Playground Device Co., Anderson, Ind. Complete specifications, construction features, prices and details of labor and materials needed for installation are included. Check the reply card.

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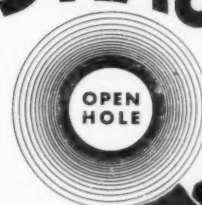
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Billions of miles of on-the-job experience have proven Ford's dependable performance and low operating costs to the big fleet owners.

Municipalities, large and small, have found Ford trucks are best for their fleets, too. To begin with, Ford's initial costs are low. Many

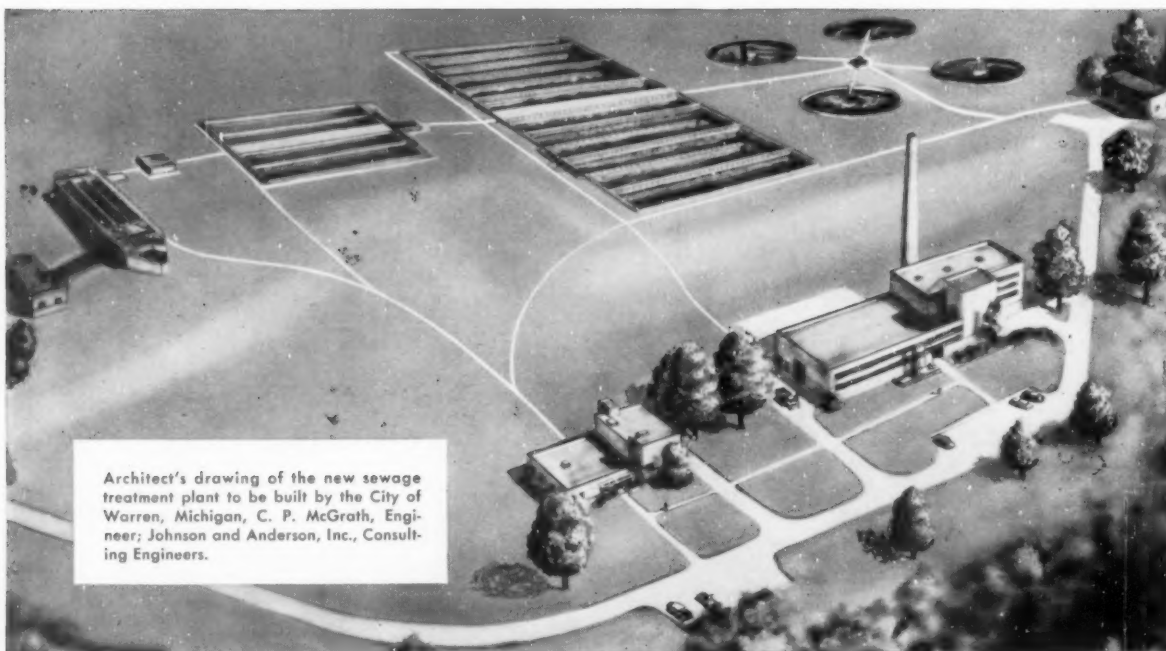
models are priced below all competitive makes. For example, the new Ford Tilt Cab models are America's lowest-priced!*

And it costs less to run a Ford truck! Thanks to modern Short Stroke power and sturdy chassis construction, operating costs and "shop time" are reduced. Another important Ford plus is longer truck life—a fact certified by independent insurance experts.

Add it all up—you'll find Ford trucks do cost less! Contact your Ford Dealer . . . let him show you why the big fleets are buying more Ford trucks than any other make.

*Based on comparison of manufacturers' suggested retail delivered prices

It's C-E Raymond for Sludge Disposal at Warren, Michigan



Architect's drawing of the new sewage treatment plant to be built by the City of Warren, Michigan, C. P. McGrath, Engineer; Johnson and Anderson, Inc., Consulting Engineers.

The new sewage treatment plant now under contract for the City of Warren, Michigan, will serve a population equivalent of 136,000 and will have an influent of 24 million gallons per day. This plant, which is part of a \$15,000,000 sewerage project, engineered by Johnson and Anderson, Inc., of Pontiac, Michigan, will serve the rapidly growing and highly industrialized Warren area immediately to the north of Detroit.

Three C-E Raymond Flash Drying Systems, operating 7 hours a day, 5 days a week, will dry or incinerate the plant's entire sludge output consisting of equal parts of straight activated and raw primary sludges. The foul air from all sludge holding tanks will be used as combustion air and will

be passed through the Deodorizing Preheaters that are a part of each of these C-E Raymond Systems. All combustion gases will be completely deodorized.

Because of the heavy concentration of diversified industry in the area, it is planned to use only one of the three C-E Raymond units to dry sludge for use as a soil conditioner. The remaining two units will incinerate primary and/or activated sludge, but can be quickly and easily converted to fertilizer production.

If you are considering new sewage disposal facilities, see C-E. We will be happy to discuss your needs with you and with your consultants. No obligation, of course.

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The effectiveness of Ozone has been demonstrated in a wide variety of applications including:

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Drainage Ditches	Kennels
Incinerators	Rendering Plants
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Sewer Breaks	Cheese, Cannery and
Sludge De-watering	other Food Plants
Fish Market Areas	

OZONE CHECKS CAUSE OF ODOR. In addition to being a good masking agent, Ozone attacks the cause of odors in many cases. It halts the development of sulfur-splitting bacteria. This is significant since this "breed" of bacteria is responsible for unpleasant hydrogen sulfide odors. In addition, Ozone's action retards the growth of mold micro-organisms which are related to the smelly decomposition of garbage and many waste materials.

ECONOMICAL, MIXES WITH WATER. Ozone mixes readily with water, can be fed directly into sewage lines or can be diluted for effective spray application. Small quantities are required—it has taken as little as two quarts of Ozone a day to eliminate odors from 450,000 gallons of sewage.

OZONE CUTS FILTER FLY, SLIME, GREASE PROBLEMS. The use of Ozone for odor control has developed several additional benefits of prime importance to sewage plant operators. Users have found that it eliminates filter flies and cuts slime and grease deposits.

OZONE MAY SOLVE YOUR ODOR PROBLEM. Write us today—giving details of your particular problem. Without cost on your part, let us send you our recommendation. Test samples and helpful additional information are yours for the asking. Fill in the coupon and mail today.



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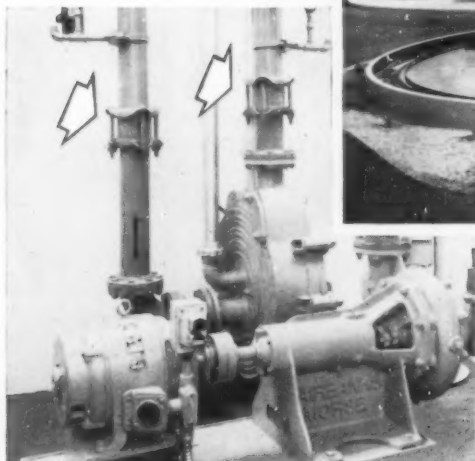
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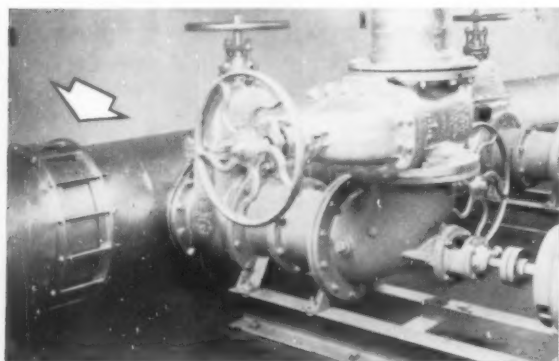
▲ Dresser Couplings insure efficient leakproof performance in the vital piping system of this modern sewage treatment plant at Fillmore, Calif.

◀ Dresser Couplings on the sludge feed and discharge lines of this heat exchanger made this unit easy to install and easy to service whenever necessary.

Dresser Couplings Help Fillmore, Calif., Build Expandable Sewage Treatment Plant

When the city of Fillmore, Calif., recently completed construction of its modern sewage treatment plant, Dresser Couplings and steel pipe helped solve sewage handling problems not only for the present, but also for generations to come.

The new plant serves a growing community of 5,000, has a present capacity to serve 7,500, and is designed so that its capacity can be doubled, for a moderate additional investment, when future growth of the city requires it.



Dresser 24" Coupling provides a permanent, leakproof seal on this line leading the clarifiers to the biofilter.

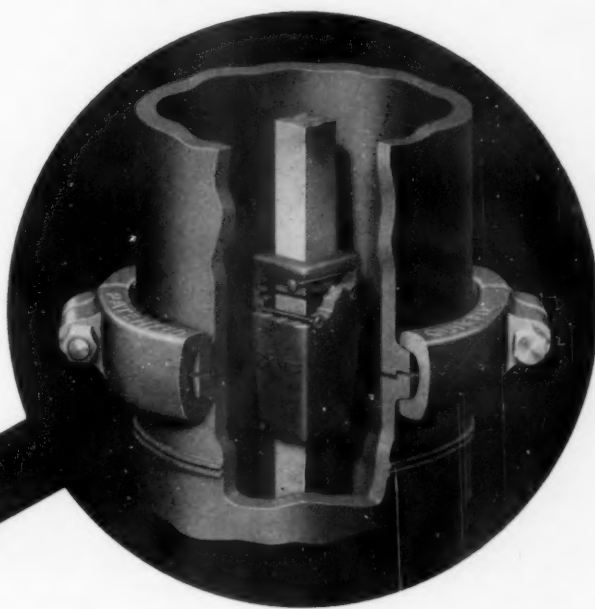
The present single-stage plant can be expanded to a two-stage plant with double the capacity, by the addition of only one clarifier, one biofilter, and one new sludge digester.

Bennett Engineering Co., designers and builders of the new plant, made good use of Dresser Couplings in assembly of the plant's adaptable piping system. James D. Parsons, partner in the engineering firm, says: "We have used Dresser Couplings for the last 20 years. We have found them to be reliable, easy to install and easy to maintain."

A wrench is the only tool needed to make a permanent, leakproof joint with Dresser Couplings . . . no welding, threading or flanging is necessary. The couplings absorb vibration from pumps and equipment. Dresser Couplings are available in a complete range of sizes from 3/8" through 72" and above, from your local piping supply distributor. For complete information about Dresser Couplings for water, sewage, and industrial waste projects, write: Dresser Manufacturing Division, Bradford, Pa. Sales offices in: New York, Philadelphia, Chicago, S. San Francisco, Houston, Denver. In Canada: Toronto, and Calgary.



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HERE'S an unmatched combination for those locations where traffic mishaps are frequent. First, you gain all the unique advantages of Darling's standard B-50-B design, with its ball bearing operation and "O" ring seals. Easier, quicker operation . . . no packing gland maintenance . . . no water seepage to operating threads or bearings . . . no loss of lubricant.

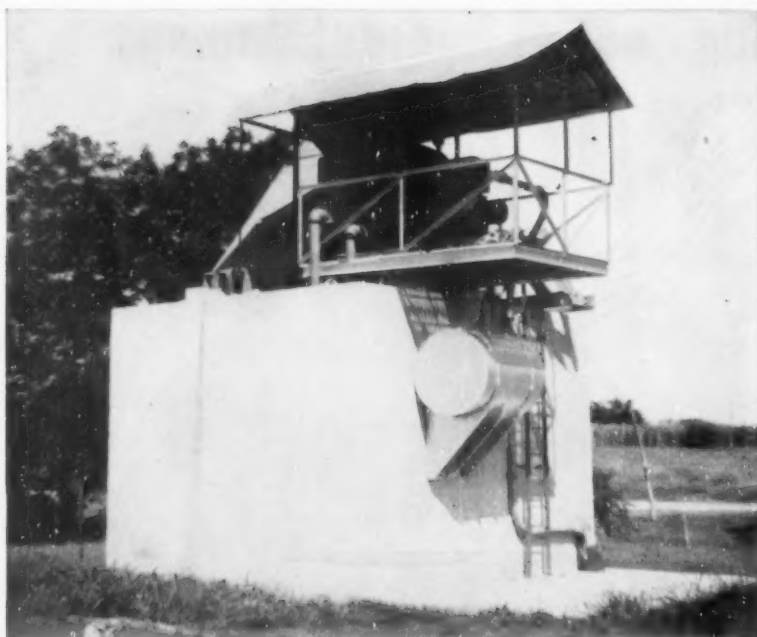
And when destructive impact does occur, Darling's improved breakable barrel and valve rod couplings "take the rap". Both hydrant barrel sections remain undamaged and intact. Moreover, on-the-spot repair is a quick cinch. Note how the barrel coupling is segmented—four pieces—for easiest, minimum part replacement.

Better get *all* the facts about Darling QUIKFIX B-50-B's and see how *much* you can gain and save. Write:

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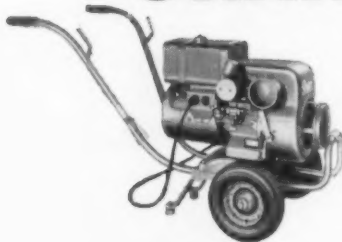
When floods come up and power lines go down... this sewage pump keeps pumping

Flash floods are a constant threat to the San Marcos (Texas) sewage system. On occasions, flood waters flow 15 feet deep over the underground sewage pump. In addition, the floods sometimes interrupt electric power to the pump.

San Marcos' city officials solved both these problems with the installation shown above. The concrete structure bars flood waters from the sewage pump and it also serves as a mounting for the Onan Emergency Electric Plant safely above the reach of flood waters. When power is interrupted, the 50KW Onan Electric Plant takes over the power load . . . supplying current for the sewage pump and other essential uses.

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UTILIZATION OF HIGHWAY ENGINEERING MANPOWER

This bulletin contains nine papers presented at the 35th Annual Meeting of the Highway Research Board. Topics covered are: "Observed Manpower Requirements; Six - State Classification Study of Engineering Personnel; Michigan Engineering Trend Study; Local Highway Engineering Manpower; Appraisal and Action; Potential Supply of Manpower for an Expanded Secondary Road Program; Minnesota's Organization and Methods Section; Time-Saving Ideas in Highway Engineering; Increasing Productivity in Engineering; and Utilizing Business Machines in Traverse and Earthwork Computations." Copies available from Highway Research Board, 2101 Constitution, Washington, D. C. Price per bulletin \$2.20.

BUILDING COST MANUAL

This book provides an over-all, up-to-date acquaintance with the costs of construction of buildings of varying types. It deals with construction costs of 150 different building types and includes introductory material on factors affecting building costs, estimating building costs, depreciation and regional variations in building costs. It presents over 80 case studies of building type costs with all necessary data and photographs of several examples of each type. This manual was prepared under the direction of The Joint Committee on Building Costs of the Chicago Chapter of The American Institute of Architects and the Appraisers Division of The Chicago Real Estate Board. Publishers are John Wiley & Sons, Inc. Price per copy is \$15.

TEXTBOOK ON SURVEYING

The usual field and office practices in land surveys, in leveling, and in topographical surveys are thoroughly covered in this text. The chapter on Lines and Grades is particularly designed to give an insight into the surveying problems that arise in connection with engineering construction. The text relating to

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American Public Works Ass'n
Anaheim, Calif., May 9th

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Springfield, Ohio, May 10

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American Water Works Ass'n
Atlantic City, N. J., May 12-17

Maryland-Delaware Sewage & Industrial Waste Ass'n
Ocean City, Md., May 22-24

American Public Works Ass'n
Augusta, Georgia, May 30-31

New Jersey Section, AWWA
Summit, New Jersey, June 6

Pennsylvania Section, AWWA
Bedford Springs, Pa., June 12-14

International Municipal Signal Ass'n, Southwest Section
Amarillo, Texas, June 13-15

New York Sewage and Industrial Wastes Ass'n
Lake Placid, N. Y., June 17-18

Ohio Sewage and Industrial Wastes Ass'n
Dayton, Ohio, June 19-21

Iowa Sewage and Industrial Wastes Ass'n
Des Moines, Iowa, June 19-21

Central States Sewage and Industrial Wastes Ass'n
Chicago, Ill., June 26-28

Pennsylvania Sewage and Industrial Wastes Ass'n
University Park, Pa., Aug. 28-30

Wisconsin Section, AWWA
Milwaukee, Wisconsin, Sept. 4-6

New York Section, AWWA
Lake Placid, N. Y., Sept. 11-13

South Dakota Sewage and Industrial Wastes Ass'n
Sioux Falls, S. D., Sept. 11-13

New England Water Works Ass'n
Boston, Mass., Sept. 15-18

International Municipal Signal Ass'n
Miami Beach, Fla., Sept. 16-19

Ohio Section, AWWA
Cincinnati, Ohio, Sept. 18-20
Public Works Congress and Equipment Show
Philadelphia, Pa., Sept. 22-25

Kentucky-Tennessee Sewage and Industrial Wastes Ass'n
Louisville, Ky., Sept. 23-25

Michigan Section, AWWA
Detroit, Michigan, Sept. 25-27

Okla. Sewage and Industrial Wastes Ass'n
Stillwater, Okla., Sept. 25-26

North Central Section, AWWA
Fargo, N. D., Sept. 25-27

Federation of Sewage and Industrial Wastes Ass'n
Boston, Mass., Oct. 7-10

American Public Health Ass'n
Cleveland, Ohio, Nov. 11-15

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The powerful packing action readily handles all types of refuse. Comparatively, Daybrook's Power Packer puts more material in a given body size. Available in standard body capacities for tandem or single-axle trucks.

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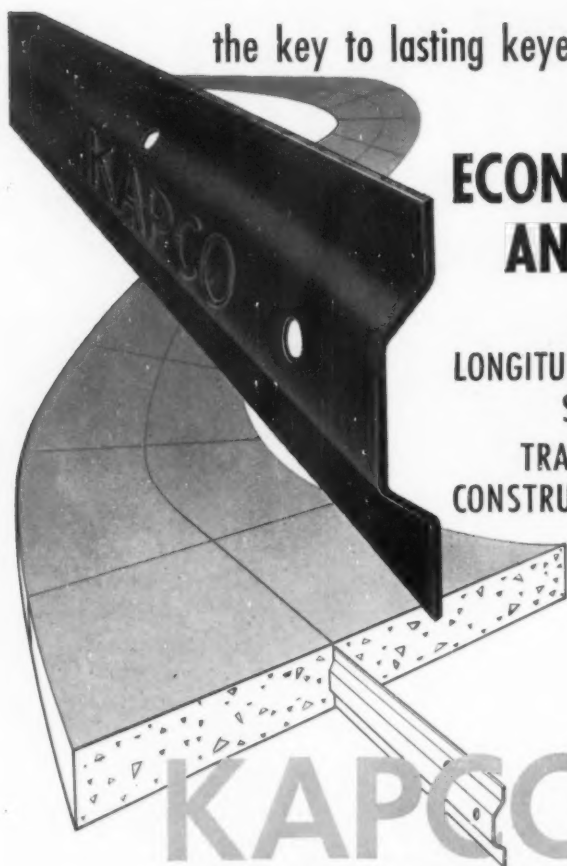
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DURABLE IN SERVICE:

Preformed mastic composition absorbs expansion of slab — without extrusion. An effective, efficient bearing surface between slabs to prevent spalling at joint surfaces. Won't rust or rot.

RIGID:

More than sufficient strength to resist deforming forces of concrete placement . . . yet lightweight and easy to install.

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Won't rust or rot; absorbs no more than 8% water by test.

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Public Lands Surveys contains the latest practice. The chapter on Cross-sections and Volumes is complete. The Aerial Surveying and Photogrammetry chapter include the latest practice and emphasizes the usefulness of this method for producing maps and for obtaining survey data for engineering projects. A single land survey has been carried along from chapter to chapter, including the original survey, its field-notes, its computations, and, finally, the finished map. 2nd Edition. The author is Charles B. Breed and the publishers are John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price per copy is \$5.50.

**A BASIC GUIDE FOR
PARKING & TRAFFIC SURVEYS**

The City of Hollywood, Florida (Pop. 30,000) has just completed a \$200,000 parking and traffic improvement program. In order to assist other cities which are currently faced with either parking or traffic problems, the city is publishing a 42-page guide which outlines the methods of procedure for conducting a parking and traffic survey in small cities. This guide explains in detail how the survey should be organized, how it was carried out, and how it was sold to the public. It contains questionnaire forms, maps, diagrams, and suggestions for illustrating the tabulations and statistical data. Copies may be obtained at \$1.50 each from Neno John Spagna, City Hall, Hollywood, Fla.

**ELEMENTARY
THEORY OF STRUCTURES**

This text is designed to present the essential principles of structural analysis in a first course for architectural and civil engineering students. It covers algebraic and graphic methods of solving problems in equilibrium of coplanar force systems; shear and bending moment in beams; stresses in trusses; analysis of roof trusses and building bents; influence diagrams; criteria for maximo-moving loads; analysis of highway and railway bridges; and deflections of beams, rigid frames, and trusses. The first ten chapters discuss statically determinate structures, while the remaining five are devoted to an introduction to the analysis of statically indeterminate structures. Authors are Chu-Kia Wang and Clarence Lewis Eckel. Publishers are McGraw-Hill Book Co., Inc., 330 West 42nd St., New York 36, N. Y. Price per copy \$7.50.

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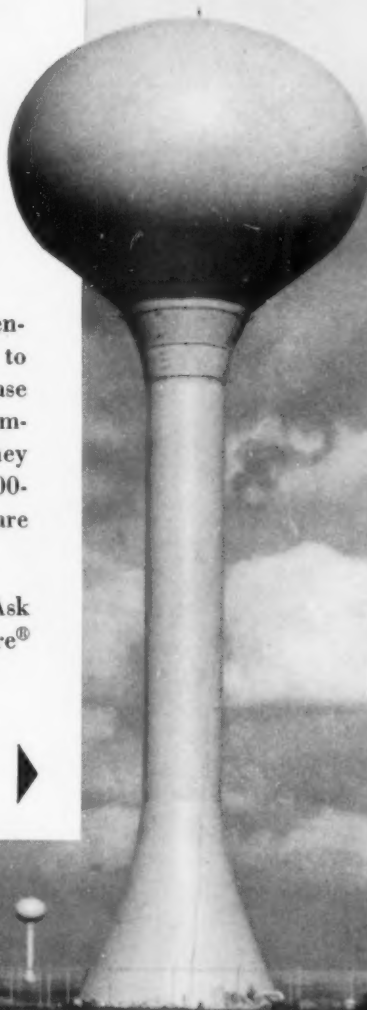
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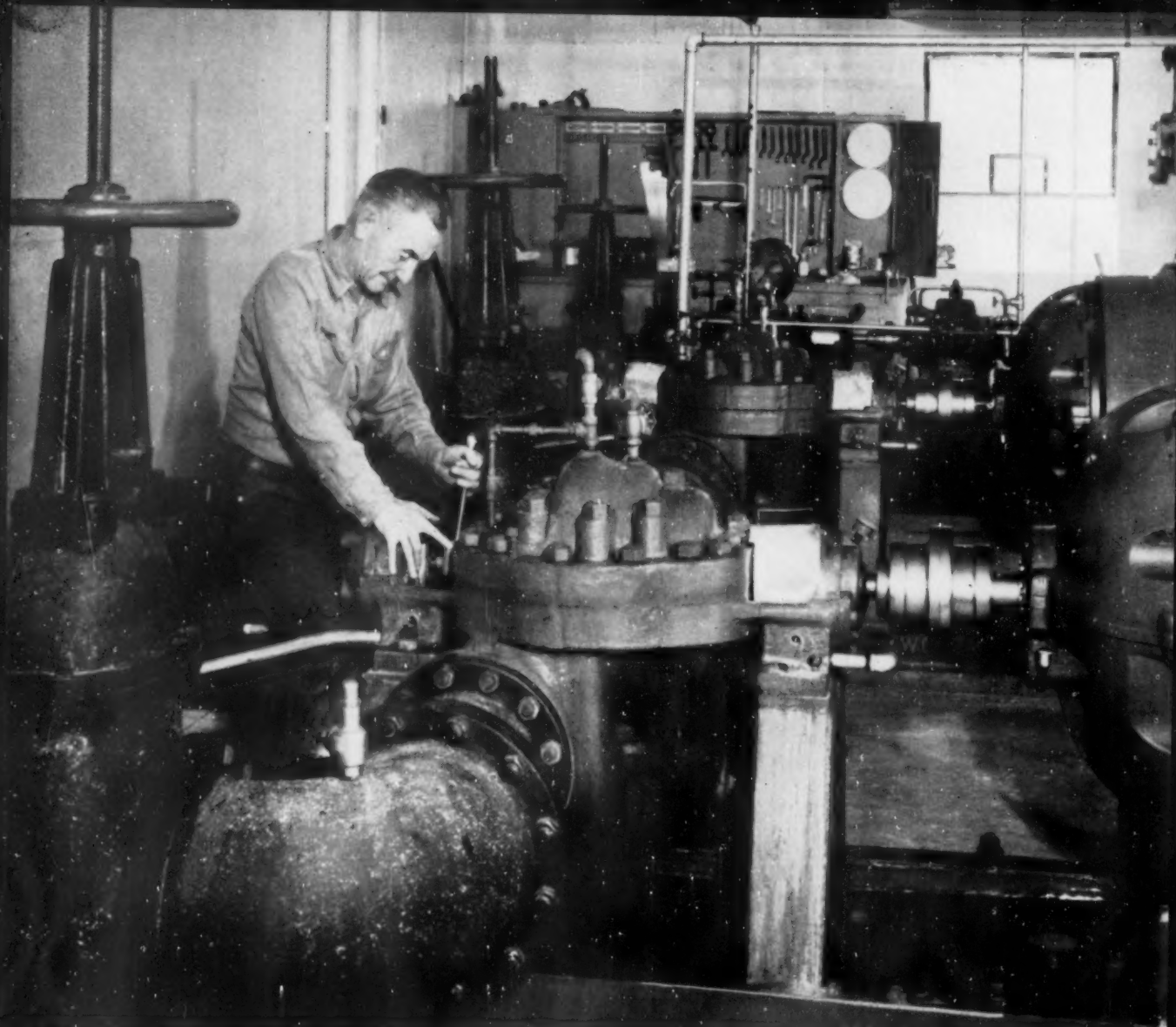
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Lake George Pumping Station, City of Colorado Springs

6 MILLION GALLONS

... of water per day are delivered to City of Colorado Springs by three Worthington 400-hp centrifugal pumps, like that in foreground, at Lake George Pumping Station. A 200-hp engine-driven Worthington is on standby service. This installation was engineered by Black and Veatch Co. of Kansas City, Mo., to meet the demand for water in the City of Colorado Springs, where a population increase of 50% in 10 years, expanding industry, and the new Air Force Academy have greatly spurred water requirements.

The Worthington equipped sta-

tions pump water through a total pipeline distance of 92,810 feet with a lift of 1,580 vertical feet. Each station contains three 400-hp Worthington centrifugal pumps each of 2-mgd capacity. A 200-hp gasoline-engine-driven pump on standby service in each station provides minimum flow in case of power failure to prevent possible freezing of the lines.

Colorado Springs also obtains water from Fountain Creek Valley. This water is pumped to a common sump by four 30-hp pumps and from the sump to the distribution system by

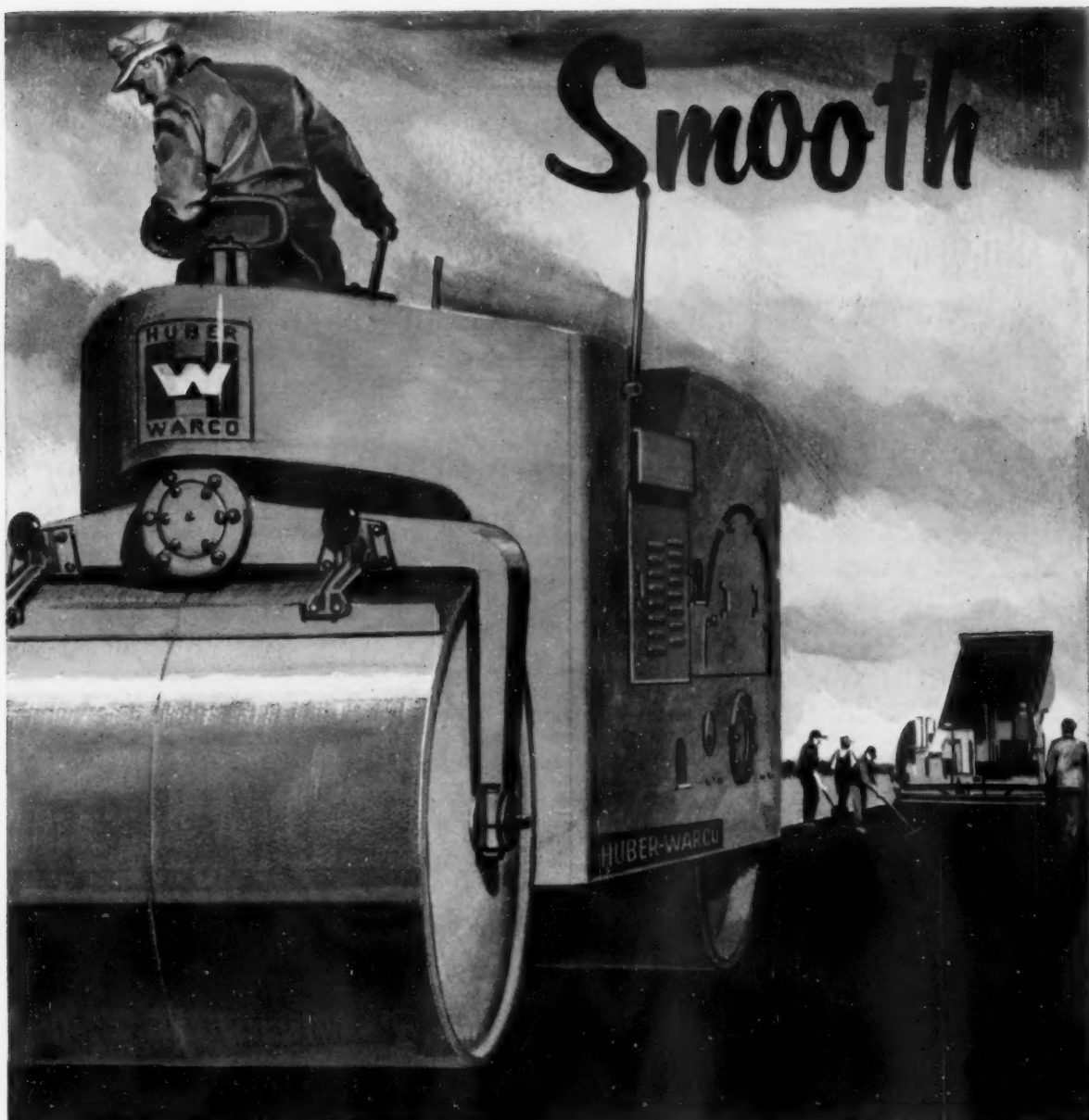
three 300-hp pumps—all seven pumps being Worthington vertical turbines.

The Colorado Springs water works installation is typical of thousands using rugged, reliable Worthington public works equipment—pumps, engines, compressors, turbines. Worthington engineers will be glad to help you apply this equipment to your water works or sewage needs. Write Worthington Corporation, Public Works Division, Harrison, N. J.

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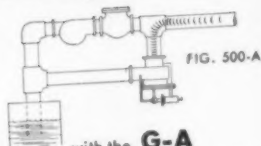
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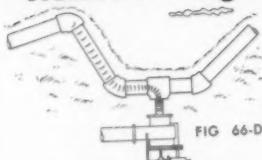


with the G-A ANTI-SURGE VALVE

Bulletin W-16

Valve opens on pump shut down—before surge occurs. Valve closes slowly at predetermined speed as pressure subsides—but is equipped to reopen for any re-occurring surge symptoms.

Relieve Surge

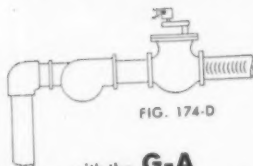


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Bulletin W-2

When surges are initiated by the gradient of the pipe line, or by quick shut-off in the line, the pipe is protected and relief provided by G-A Surge relief valves.

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LEGAL ASPECTS OF PUBLIC WORKS

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Blasted Sewer

Lundahl v. City of Idaho Falls, 303 Pac. (2d) 667, an Idaho case decided Dec. 4 1956, was an action by a property owner against the City for damage which occurred during blasting for a sewer line in an adjacent alley. The work was done by an independent contractor hired by the City.

While engaged in the excavation work, the contractor exploded large quantities of explosives at a point in the alley about eight feet from the south wall of the garage and "thereby produced great and violent concussions and vibrations of the earth and air which shook the said land and building of the plaintiff and the air above and around them and caused great injury to the lava substrata underlying soil land and building by cracking and breaking same, and causing great injury to the foundation of said building and whole superstructure, including its walls, windows, ceilings and chimneys, and rendered the same unsafe and uninhabitable."

The plaintiff's suit was dismissed by the trial court, on the ground that the activity was governmental, rather than proprietary, so that the City was immune from liability—and further, that the City would in any event not be liable for the tort of an independent contractor. The plaintiff then appealed to the Supreme Court of Idaho, which reversed the dismissal and sent the case back for trial.

The appellate court said that the construction of a sewer was, according to the weight of authority (although not uniformly so held), a proprietary function, so that the City had no immunity. It was further held that the City was liable despite the fact that the damage was done by an independent contractor rather than by an employee or of-

ficer of the City, on the ground that the activity was carried on in such a way as to constitute a nuisance, of which the City had been warned. This is one of the exceptions to the rule of non-liability for acts of an independent contractor. As the court said, "A person must not suffer a nuisance to continue on his premises to the injury of others, although he is not responsible for its creation."

Meter Teeter

Halz v. City of Pittsburgh, 127 Atl. (2d) 89, a Pennsylvania case decided Nov. 27, 1956, involved an action by a pedestrian against the City of Pittsburgh and also against a property-owning water customer of the City, for injuries received in a fall caused by the teetering of a water meter cover which was located at ground level between paved portions of the sidewalk and curb in front of the customer's property.

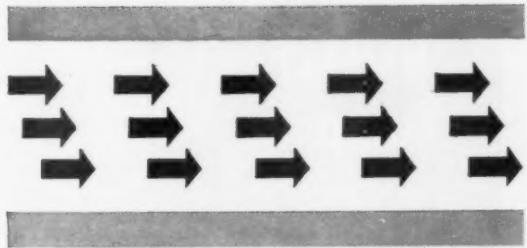
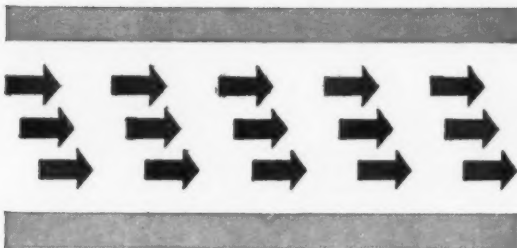
The jury gave a verdict for \$13,000 against the City and refused to give a corresponding verdict against the property-owner, despite the trial court's instruction that they were liable jointly in the same amount.

On appeal, the Supreme Court of Pennsylvania held that the distribution of water is a proprietary, and not a governmental function, and that the City and the property-owner were jointly negligent in failing to maintain the meter properly, and therefore jointly liable. The case was sent back for re-trial because of the jury's failure to bring in a joint judgment against both defendants. However, the court pointed out that if the plaintiff collected from the City, the City would have no right of indemnification against the property-owner customer, as each was negligent and there is no contribution or indemnification between joint tort-feasors.

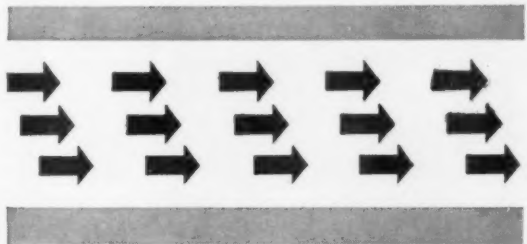
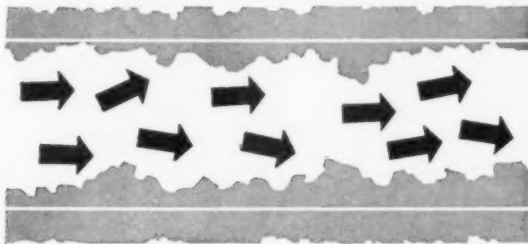
OLD-FASHIONED PIPE

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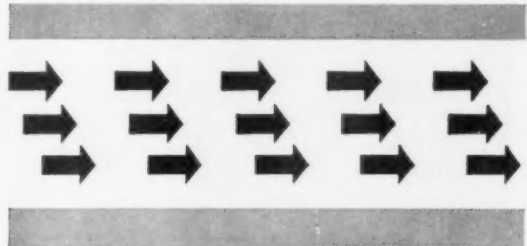
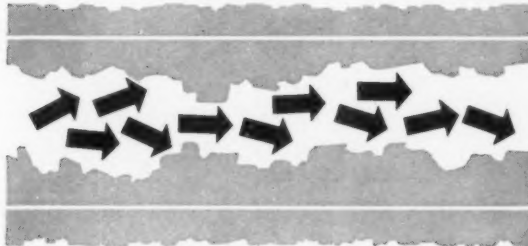
When installed



After a few years



After many years



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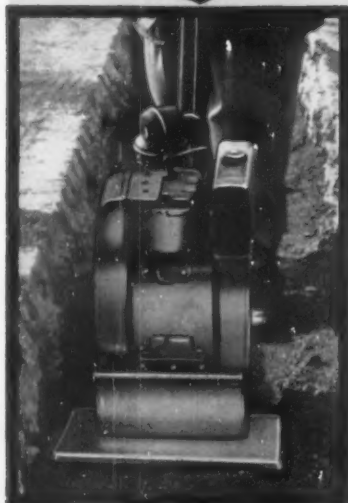
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A prominent manufacturer serving the water works, sewerage and industrial fields, needs a man in the New York City area for sales work. There are openings also in other areas of the country. Preferable age limits are 25 to 34. Good salary to start and bonus arrangement. Public works or sanitary background desirable. Write Box SL-5, Public Works Magazine, 200 South Broad St., Ridgewood, N. J. Replies will be forwarded without acknowledgment.

Traffic and Safety on Garden State Parkway

The following material is from the 1956 Annual Report of the Garden State Parkway, New Jersey Highway Authority. The Parkway fatality rate for 1956 just about equalled its nationally-low mark of the preceding year. In 1955, the fatality was 1.2 per 100 million vehicle miles; in 1956, the fatality rate was 1.3. There were 13 fatalities on the Parkway during 1956, including 1 pedestrian. Parkway regulations bar pedestrians from use of the roadways.

Without counting the traffic over free sections, approximately 50 million vehicles were recorded at toll stations during 1956. During the year, State Police on the Parkway rendered various forms of aid to 21,975 motorists. These aids included the summoning of emergency service for vehicles out of gasoline or otherwise disabled. A total of 7,824 summonses was issued by the State Troopers, including 3,202 for speeding over the 60 miles-per-hour Parkway limit.

Service and Communications on the Northern Illinois Toll Highway

The communications system on the Northern Illinois Toll Highway will be based on micro-wave radio transmission with separate VHF (very high frequency) channels for policing and maintenance. The system will be linked to three Illinois state police districts and can be tied to the Indiana Toll Highway police system.

There will be eight district maintenance buildings, each serving as district maintenance headquarters. Each district will serve a tollway section about 25 miles in length. In many cases, these maintenance buildings are adjacent to toll plazas.



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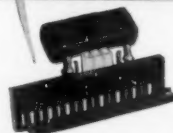
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HOPTO MODEL 360 57-90—Big capacity 90 GPM triple tandem pump and split hydraulic system handles half-yard backhoe. Full 360° continuous swing from over cab position.

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Heaviest-duty, Largest GPM Hydraulic System Available

HOPTO MODEL 190 SPC—Complete self-propelled track unit handles up to 30" backhoe. 190° continuous swing.

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HOPTO MODEL RTM—A HOPTO designed for mounting on rubber-tired tractors. Handles up to 30" buckets. 180° continuous swing. Front end loader mounts directly on HOPTO frame.

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GET THESE HOPTO ADVANTAGES:

- Fast-cycling, completely hydraulic operation—no clutches, brakes, drums or cables.
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STILL MORE MODELS

HOPTO offers 3 models for truck mounting, self-powered or PTO-drive trailer models, and the self-propelled rubber-tired Model SPR.

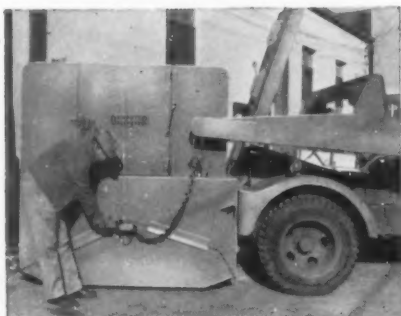
Write today for complete information or see your HOPTO Dealer!



BADGER MACHINE COMPANY

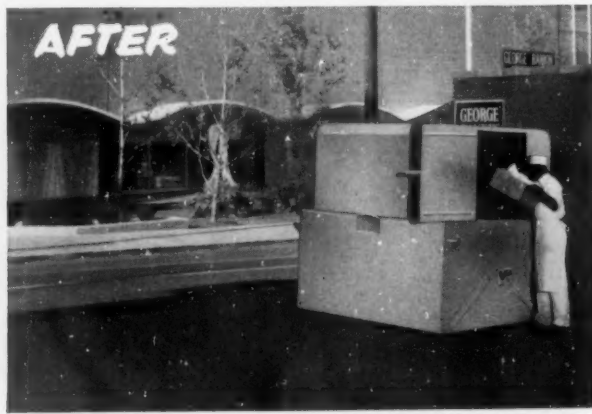
DEPT. P • WINONA, MINNESOTA

Look what's happening



Here is Plainview's Dempster-Dumpster serving one of its 58 Detachable Containers.

TWO PHOTOS at bottom of page serve as typical examples of scenes, wherever trash and refuse are collected, BEFORE and AFTER a Dempster-Dumpster Container is installed.



DEMPSTER

to bulk refuse collection!

Cities, large and small, installing Dempster-Dumpster System featuring large capacity fire-proof, scavenger-proof steel Detachable Containers. Scores of them handled by only one man...cutting cost tremendously!

THERE IS A WAY to eliminate your bulk refuse handling problem... open cans, crates and boxes with overflowing refuse... rats feeding on it... wind scattering loose rubbish... dogs and cats munching in the mess... flies buzzing around the stuff—a costly potential in disease and fire hazards alone in damage to persons and property. And, the equipment and labor cost of collection is tremendous. There's a simple, economical and nationally recognized solution to this problem. Big steel Dempster-Dumpster Containers located at convenient bulk refuse accumulation points—each equivalent to 75 ordinary trash cans—in your business areas... in housing and apartment areas... at schools, hospitals, etc. Scores of them—25, 30, 40, 50—served on schedule by only one man, the driver of your truck-mounted Dempster-Dumpster.

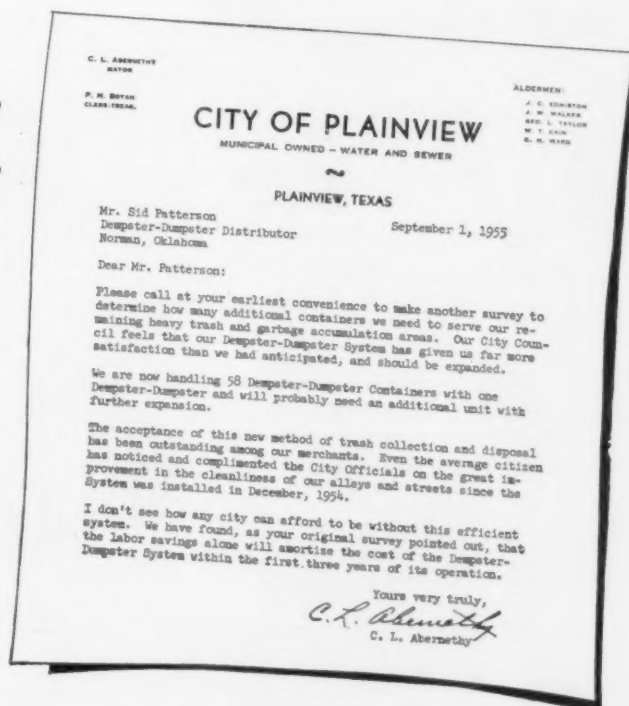
You can understand why officials like Mayor Abernethy of Plainview say: "I don't see how

any city can afford to be without this efficient system." Praiseworthy satisfaction is the result in other cities—Borger, Pampa, Odessa and Lubbock in Texas, for instance. Atlanta... Baltimore... Davenport, Iowa... Henderson, Ky... Jackson, Tenn... Lakeland, Fla... Wilmington, N. C... Richmond, Va... Rochester... New York City... Denver... Montgomery, Ala... Wyandotte, Michigan and many, many others.

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"How can any city do without it --" says Plainview's Mayor Abernethy.

Wherever the Dempster-Dumpster System is in use, satisfaction beyond that anticipated is the same as expressed here by Mayor Abernethy. Your city, too, can save thousands of dollars and, at the same time, eliminate fire and health hazards and improve the cleanliness and appearance of your heavy producing districts with this amazing system. A survey of your bulk refuse collection may be arranged without obligation.



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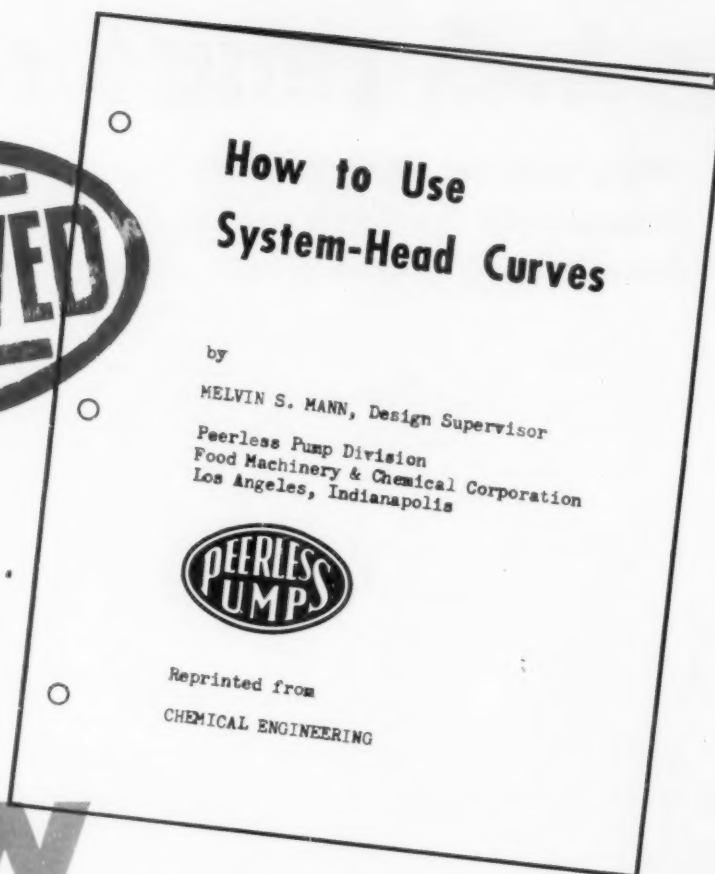


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Work basket and insulated outer beam protects work-
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The AB-1-41 ... having ground-to-basket floor height
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carries two men up, out, over, or down. Available
in 37' and 43' ground-to-basket heights.



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Costs of city work seem too high?

LOOK HOW SANGAMO CONSTRUCTION CO. CUTS THEM

This well-known 30-year-old Springfield (Illinois) firm, a year ago, had a problem common to most city-area contractors. Moving costs and traffic slow-downs were taking much of the profit out of their municipal work. Small, extra, one-day or weekend jobs, which *could* have built income, often couldn't be handled because, like many contractors, their equipment was either too small or too big. Sangamo, however, found a solution. They bought Michigan Tractor Shovels. Today, their \$3,000,000 annual volume is *largely* in city work and *three* of their busiest, most profitable machines are Michigans.



Does job of bigger machines setting 12 inch sewer pipe

Often, one of the Michigans is assigned to a major job where maneuverability is a vital factor in speeding completion. Above picture shows typical task of this type—laying eight miles of 8, 10, and 12-inch sewer pipe for the city of Decatur (Illinois). Daily—almost hourly—this Model 75A shuttled between *three* crews. Tasks included pushing spoil away from trencher . . . back-filling . . . transporting and laying pipe. At times, it set manholes weighing 1200 to 1500 lbs per ring section. Biggest advantages proved to be speed (a typical half-mile trip took 75 seconds) . . . rugged construction (in a summer of work, no time was lost from the job for repairs) . . . planetary axles (which eliminated all axle breakage despite rugged lifting demands)



Drive, turn non-stop on narrowest city streets

All these units can be on their way to any kind of loader job in minutes. "These rigs go anywhere," says Clyde Turner, one of Sangamo's job superintendents. "They can run three or four blocks, through auto and truck traffic, in a minute or so. Twenty-seven miles takes only an hour. Rubber tires don't tear up asphalt or oil-mat pavement. They can even go up on a sidewalk without breaking it or the curbing. And our Model 75A's (which are 6' 8" wide and 16' 10" long) can turn around non-stop on the narrowest city streets."



Carries 1800 lb water main section

Bigger loads have been no problem for the Michigans, either. Above, the second of Sangamo's 80 hp Model 75A's carries an 1,800 lb, 18 ft section of 20 inch water main. This unit *can* lift 8,000 lbs while standing still . . . can carry 4,000 lbs at 4 mph.



Clears, loads 1,000 yards of rubble in 1½ days

Sangamo's third Michigan Tractor Shovel, a 95 hp, 2 yard Model 125A, also handles assignments where speed is important. Here it's on a historical job in Springfield—clearing the wreckage of Illinois' first governor's mansion to make way for a parking lot. Entire 1,000 cubic yards of rubble and dirt was piled and loaded out in 1½ days. Sangamo Construction bought this machine, their first Michigan Tractor Shovel, after having it demonstrated (to quote Company President, Bill Kewley) "on the toughest tractor shovel work we could find—digging up wet rocky ground to improve drainage around a Springfield sewage treatment plant. Later," Kewley continues, "it proved so handy and so dependable, all our crews wanted one. So, in 5 months, we bought our second Michigan, and 3 months later, our third."



Full buckets are the trademark of all Sangamo's Michigans. Here the Model 125A, bin-storing hot mix material, carries *more* than its rated 2 yard capacity. Unexcelled breakout force, low-level tipback, and low-level-carry result in the delivery of big loads every time, the operator says.

Stockpiling gravel is another job for the busy Model 125A. While at this city-located yard, rig sometimes loads trucks and railroad cars, feeds the crusher, does cleanup. Its standard 2 yard bucket, incidentally, is interchangeable with 2¾ yard light-material bucket.



The model 75A's standard 1¼ yard bucket interchanges with ¾ and 2 yard sizes. Both models can also be equipped with crane hooks, fork lifts, backfiller blades, scarifiers and root rakes. For small jobs you can get a Michigan Model 12B with 6, 10, 16, 20, or 27 cubic foot capacity . . . for big jobs you can get a Michigan Model 175A with 1½, 2, 2¾ (standard), 4 or 5 cubic yard capacity. For help in determining which of these four models, or which of their 35 different buckets and attachments, *best fits your needs*, ask one of our job study engineers to study your layout. Feel free to call or write us any time for this service. It's free, of course and realistic . . . and will put you under no obligation whatsoever.

Michigan is a registered trade-mark of

**CLARK
EQUIPMENT**

CLARK EQUIPMENT COMPANY
Construction Machinery Division
2499 Pipestone Road
Benton Harbor 35, Michigan
In Canada: Canadian Clark, Ltd.
St. Thomas, Ontario

Good Water is a ...

Longtime Investment



... ample reason why the
dependability of the mechanical
equipment is of real importance.

Roberts-equipped plants are
noted for their year-in, year-out
efficient operation.

Choose Roberts Filter, and be sure.

MECHANICAL EQUIPMENT
BY
ROBERTS FILTER MFG. CO.
DARBY, PENNA.



Switch to sludge-free Purex Salt



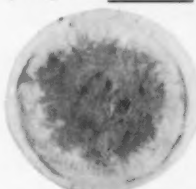
In every 100 lbs. of rock salt you buy you assume the risk of paying for up to 5 lbs. of insolubles or sludge—shale and sulphates. This means that in a 50-ton carload of rock salt you may pay for as much as 5,000 lbs. of sludge!

This insoluble matter is included in the purchase price of the rock salt and accounts for part of your freight bill. It also necessitates periodic cleaning out of your brine making system.

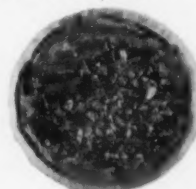
But when you buy Morton Purex Salt, you get high-purity evaporated salt that is made in a controlled particle size to prevent packing and channeling. With Purex, none of your purchase price or freight bill goes toward paying for insolubles or sludge.

With Purex, no time or labor is wasted in cleaning out insoluble matter from your brine making system to keep it functioning at peak capacity. For Purex is 100% soluble. Morton Purex Salt will leave no accumulation of material in either the brine or water softener tanks. It can be used in bulk wet storage systems and in the Morton Model E Brinemaker.

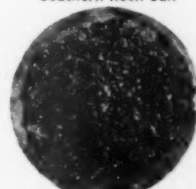
These filter pads (approximately 1/5 actual size) show you how much insoluble matter (sludge) you get in just 5 lbs. of various kinds of salt.



Southern Rock Salt



Northern Rock Salt



Kansas Rock Salt



Morton Purex Evaporated Salt

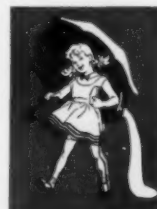
Tests for insolubles taken from these random samples show you that Morton Purex is the only one that contains no wasteful sludge, or insolubles.

For more information about Morton Purex Salt and for free, expert help on any water softening or brine making problem, write or wire:

MORTON SALT COMPANY

INDUSTRIAL DIVISION

Dept. PW-5, 120 So. LaSalle Street,
Chicago 3, Illinois



DON'T PAY IT!



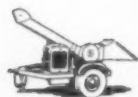
Don't pay the high cost of loading and hauling brush when a rugged, efficient Asplundh Chipper can save you as much as 75% of this expense.



ASPLUNDH CHIPPERS completely eliminate brush loading, cut hauling drastically. Comparison shows 1 truck-load of chips equals at least 4 of brush. And an Asplundh Chipper does away with burning, too; a boost to your public relations.

Yes, however you look at the problem of brush removal, an Asplundh Chipper is a substantial cost-saving. *It is designed to do the job . . . has been proven in use by the largest tree company in the world.* It's efficient, powerful, so simple in design that maintenance is reduced to an absolute minimum.

Send now for complete details . . . better still, ask for a no-obligation demonstration. See why Asplundh is the fastest-selling chipper made . . . why it merits the reputation as the accepted standard throughout the world.



**Detach and
mail coupon
today!**

ASPLUNDH CHIPPER COMPANY

505 York Road, Jenkintown, Pa.

Dept. PC

☐ Send FREE folder: The Modern Approach to the Brush Problem

☐ Arrange for FREE demonstration

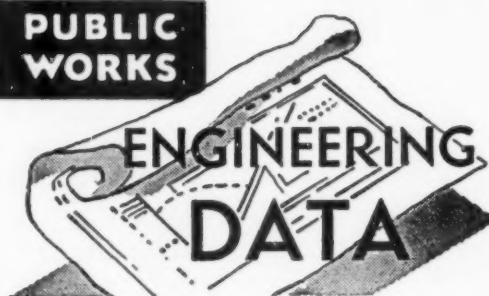
NAME

ADDRESS

CITY ZONE STATE

BY ACTUAL TEST THE FASTEST CHIPPER MADE

PUBLIC WORKS



Routine Road Maintenance Costs in a Minnesota County

Routine maintenance costs on 200.5 miles of State Aid road in Benton Co., Minn., J. D. Kotsmith, Highway Engineer, were per mile, during 1956: Smoothing surface \$47.05; minor surface repair \$34.05; roadside and drainage \$16.47; brush and weed control \$28.62; snow and ice control \$48.68; and traffic service \$21.36. On 238.7 miles of County Aid roads, similar costs were: Smoothing surface \$50.50; minor surface repair \$5.75; roadside and drainage \$20.30; brush and weed control \$26.30; snow and ice control \$48.80; and traffic service \$7.20

Numbering and Labeling Sanitation Vehicles

Trucks and equipment operated by the Sanitation Department of El Paso, Texas, are painted white, with signs, numbers and the City Seal in black. Vehicles are marked and numbered for easy identification. Garbage trucks are marked "G"; trash trucks are "T"; street cleaning trucks are "SCD"; inspectors cars are "I"; and supervisors cars "S". Numbering is kept in sequence. On trucks, each door carries the number and the same number appears on the rear. Numbers are at least 5 inches high. Ed F. Muckelroy is Sup't., Dep't of Sanitation.

Constructing a New Capital for Brazil

Brazil plans to construct a new capital in the State of Goias. The area of the Federal District is 100 by 50 kilometers. The nearest paved highway is at Anapolis, Goias; the nearest rail line is Central de Brazil, at Pirapera.

The company charged with the construction of the public buildings and city improvement projects is Companhia Urbanizadora de Nova Capital de Brasil of Rio de Janeiro. The company is owned by the Federal Government. Plans for the construction of buildings and facilities at Brasilia currently include:

Highways—Bids have been received for construction of asphalt paved highway from Anapolis to Brasilia (125 kilometers). A second paved highway from Belo Horizonte to Brasilia (250 kilometers) is planned, but bids have not yet been requested for this.

Sewerage and Water System—The Company will build the necessary water supply and drainage systems for the new city at an estimated cost of \$7,800,000.

Airport—Two 3,300-meter paved runways are to be built, one of which is now under construction. The site is 1100 meters above sea level. This will be



Adams Filters installed at the new Delaware pool in the Town of Tonawanda, N. Y., give the water extra polish and beauty . . . a special invitation to enjoy the pleasures of this beautiful pool.

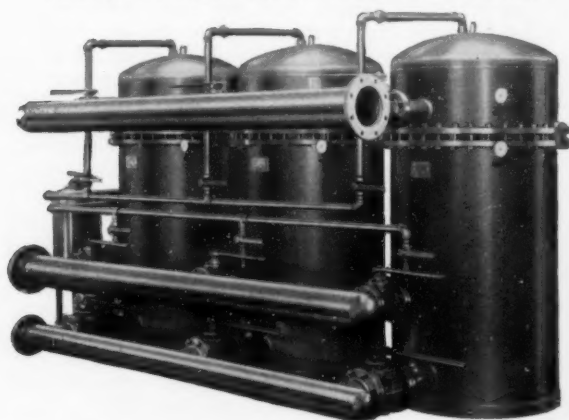
It's easy to keep your pool water Crystal Clear at Lower Costs

Hundreds of swimming pools across the nation have found that Adams filtration packages are the right answer. That's because of the advanced engineering design . . . diatomite filtration . . . permanent Poro-Stone elements . . . compact installation . . . simple operation featuring a new backwash technique.

We have a wide range of filters and delivery is prompt. You'll find the price of crystal clear water for your pool is amazingly low, so write for complete information, today.

ADAMS SP7...

TODAY'S FINEST SWIMMING POOL FILTER

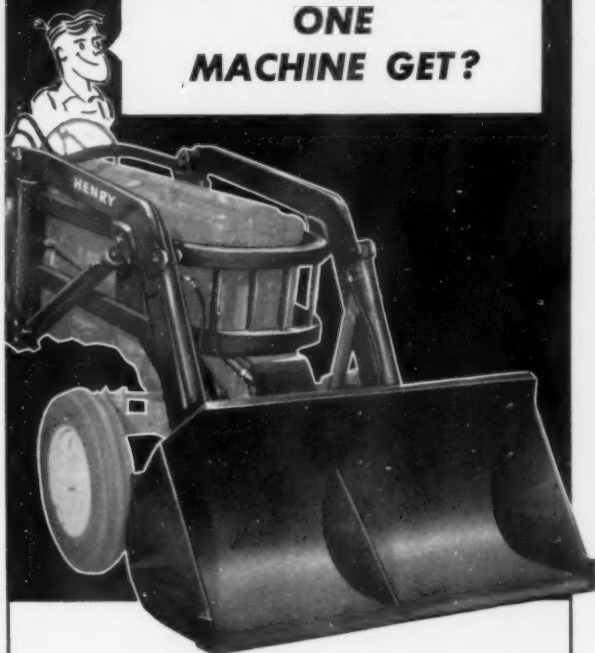


Adams SP7 filters are ideal for community pools like that illustrated above. This triple SP7 169 can handle pools up to 730,000 gallons capacity.

R. P. ADAMS CO., Inc.
228 East Park Drive, Buffalo 17, N. Y.

PUBLIC WORKS for May, 1957

HOW USEFUL CAN ONE MACHINE GET?



THE HENRY INDUSTRIAL TRACTOR SHOVEL brings solid-steel lift arms and powerful cylinders into action on every loading-leveling job. Hoists 2000 lbs.—will bulldoze anything your tractor can budge. Ten attachments available to adapt the Henry perfectly to your needs.

Custom-Built, Work-Tested Attachments . . .



By the makers of the world-famous Henry Hydraulic Backhoe
See your nearest Henry dealer
or write today for free booklet.

HENRY

HYDRAULIC all-purpose EARTH MOVERS

MANUFACTURING COMPANY, INC.
1700 North Clay St. Topeka, Kansas

"You can do it BETTER with a HENRY"

NATIONWIDE SALES and SERVICE



ARPS TRENCH HOG

Digs up to 800' an Hour At Lower Cost per Foot

Now you can handle those profitable trenching jobs without a sizeable investment in large, unwieldy equipment! A tractor-mounted Arps Trench Hog will give you big trencher performance and capacity at only a fraction of the cost.

Along with peak capacities up to 800' per hour, you get unsurpassed mobility — moving from one job to the next at the speed of the tractor itself. The Trench Hog is easy-to-handle — one-man operated for greater economy. Has rugged, all-steel frame; anti-friction bearings; extremely precise hydraulic depth control and independent drive wheel control for accurate straightaway and curved digging; seven digging speeds with depth capacities of 3½', 5½' and 7'; quick-change cutters 6" to 20" wide; special optional cutters for frozen and rocky soils; boom which raises to approximately 90° angle when traveling.

ARPS Trench Hog—Best For Any Trenching Job

- Water Mains
- Foundation Footings
- House Service Lines
- Sewage Ditches
- Septic Tank Laterals
- Gas Lines
- Drainage Ditches
- Clogged Lines and Broken Mains

Send for free literature and detailed information. Write to Arps Corporation, New Holstein, Wis., Dept. PW

ARPS
CORPORATION
NEW HOLSTEIN,
WIS.

TRENCHERS • HALF-TRACKS
BULL-DOZERS • UTILITY BLADES

an international airport when Brasilia becomes the national capital.

Method of Contracting—All contracts are "administered" cost-plus contracts, the Brasilia company determining what firms will be permitted to bid on a project and how much of the project may be built by any one company. When bids are received the company reserves the right to select other than the lowest bidder, and the final contract is written so that the company pays the cost of constructing the project, plus a fee ranging between 10 percent and 12 percent. The company may pay bills for construction materials directly to the supplier in order to maintain a degree of control over costs. With the cost of construction materials rising rapidly, the cost-plus feature of contracts is said to be necessary to protect the interests of the contractors.

Michigan County Improves 77 Miles of Road

Despite heavy wind and rain storms which curtailed the construction season, Lenawee Co., Mich., built in 1956 5.33 miles of new mat-type blacktop; 8.48 miles of mat recap; 5.0 miles of road mix over old concrete; 3.63 miles of new prime and double seal; 52.1 miles of seal on existing blacktop; and 2.6 miles of widening and sealing. In addition, more than 15 miles were graded and graveled.

During the year the county spent more than \$80,000 for new equipment including 11 Chevrolet trucks; one FWD and two GMC scraper trucks; three Root underbody scrapers; an AC earth hauler; three International power mowers; a Ford tractor loader; a LeRoi air compressor and other smaller equipment.

Ralph F. Johnson is County Highway Engineer.

Cost of Brush Spraying and Roadside Mowing

In Pennington Co., Minn., Joseph Seidel, County Engineer, the County crew sprayed 392 miles of state aid and county aid roads during 1956. The work required 656 hours of actual spraying time and cost \$5,106, or an average of \$7.78 per hour or \$13.03 per mile of road sprayed on both sides. It required 60.75 hours to spray 28.5 miles of county ditches. The cost was \$523.30, averaging \$8.58 per hour or \$18.04 per mile of ditch sprayed both sides.

Roadside mowing required 916 hours actual mowing time, making 1870 swath miles at a cost of \$1911.10, with an average cost of \$2.09 per hour and \$1.03 per swath mile. Additional private mowers worked 1548.5 hours actual mowing time, making 2821 swath miles at a cost of \$3871.25, with an average of \$2.50 per hour and \$1.37 per swath mile.

Routine maintenance on State Aid roads cost \$115.57 per mile, as follows: Smoothing surfaces \$62.25; mowing, spraying and brushing \$21.36; snow plowing and snow fencing \$30.61; and traffic service, signs, etc., \$1.35. For County Aid roads, per mile cost of routine maintenance was \$82.23, as follows: Smoothing surface \$37.96; mowing, spraying and brushing \$17.04; snow plowing and snow fencing \$26.08; and traffic services, signs, etc., \$1.15.

Photogrammetry Speeds Turnpike Surveying

Constituting one of the largest highway projects ever undertaken by photogrammetry, the Illinois Tollways were covered by 1400 overlapping photographs, each 9 inches square, taken from a height of 1500 ft.

at
Atlantic City
 and
 throughout
 America
**BETTER
 WATER
 STORAGE**
 dwells in

*elevated steel tanks
 by*

**PITTSBURGH
 -DES MOINES**

The dependable service furnished by PDM Elevated Steel Tanks is equalled by design versatility and complete range of capacities for communities of every size. We invite you to send for our descriptive "Modern Water Storage" brochure, free on request.



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ATLANTIC CITY, N.J.
 1,000,000 Gallon Radial Cone Design



Radial Cone
 2,500,000 gal.



Pedestal Sphere
 100,000 gal.



Obloidal Design
 1,000,000 gal.



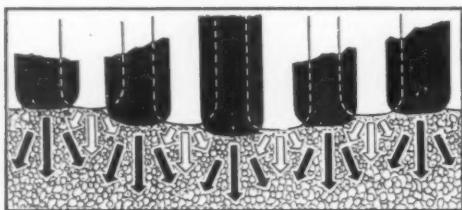
Hemispherical Bottom
 100,000 gal.



Double Ellipsoidal
 500,000 gal.



How oscillating wheels can save you untold street maintenance costs...



See the flow of compaction effort that the Bros Self-Propelled roller with torque converter drive provides for street seal coating, resurfacing and shallow lift compaction...

Here's how it is helping cities throughout the country make great savings in street maintenance costs:

- With full oscillation of all wheel pairs to provide uniform compaction, the Bros SP-54 helps "key" and "lock" aggregate materials tightly in the base course to prevent various pavement failures.
- Wheel oscillation of this roller also kneads the asphalt into a tight, solid surface, eliminating hairline cracks that would otherwise turn into

surface breaks. Very important, too, rubber tire rolling correctly imbeds the wearing course chips *without* crushing them.

- Besides such proven advantages, the Bros SP-54 offers these time-saving performance features: a torque converter drive provides smooth, easy handling and eliminates "tipping" of chips when starting; it also lessens drive line strain.
- Full-reversing type transmission with shuttle gear permits rolling in either direction without shifting; turn arounds are thus eliminated.
- Infinite speed range from 0 to 18 mph; positive chain drive to both rear wheel pairs; 50 HP engine and smooth, hydraulic steering provide fast, proper compaction results that you can't get from any other roller. See a Bros Distributor or write us for full information and/or a demonstration.

Find out, too, about the complete Bros TEAM. With the SP-54, the Bros Preparator and Roto-Mixer make the perfect combination for low cost street construction. The Preparator (in-place materials reducer) reduces native over-size materials and old blacktop to proper roadbed sizes. The Roto-Mixer stabilizes and blends the base and wearing course materials to improve load bearing values.



ROAD MACHINERY DIVISION

BROS INCORPORATED

(Formerly the WM. BROS BOILER & MFG. CO.)

1057 Tenth Ave. S.E. • Minneapolis 14, Minnesota





*cut labor costs
in park,*

*tree and
highway*

departments

mechanize, economize with ROWCO BRUSHKING®

WORLD'S LARGEST-SELLING,
PORTABLE BRUSHCUTTING MACHINE

Like having 5 extra men on your maintenance crew! Clears all brush and grass easily, quickly, at less cost! Yes, there is one obvious place where highway departments can trim budgets . . . in their maintenance, brushcutting projects! ROWCO BRUSHKING® is custom tailored for highway,



land clearance requirements. Mobile, lightweight, safe and easy to operate, it goes anywhere . . . cuts almost anything. With grass trimming attachment, it is ideal for clearing grass and weeds from parks, cemeteries and institution grounds . . . for road work, it cuts close to highway guard rail posts and fences, walls . . . reaches into drainage ditches. Clears all undergrowth, bushes, briars . . . even small trees. BRUSHKING® is rugged and fully field tested. Now in use by many municipal, county and state public works, highway and water departments . . . and pays for itself in a hurry!

SEND FOR COMPLETE DETAILS!

ROWCO Mfg. Co., 89 Emerald St., Keene, N. H.

Please rush illustrated literature on the
ROWCO BRUSHKING®

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Title _____

Address _____

City & State _____

Division of Harrington & Richardson, Inc. — Established 1871

GarWood



Coming
Next Month
from
Gar Wood...

BIGGEST NEWS IN LOAD-PACKER[®] HISTORY!

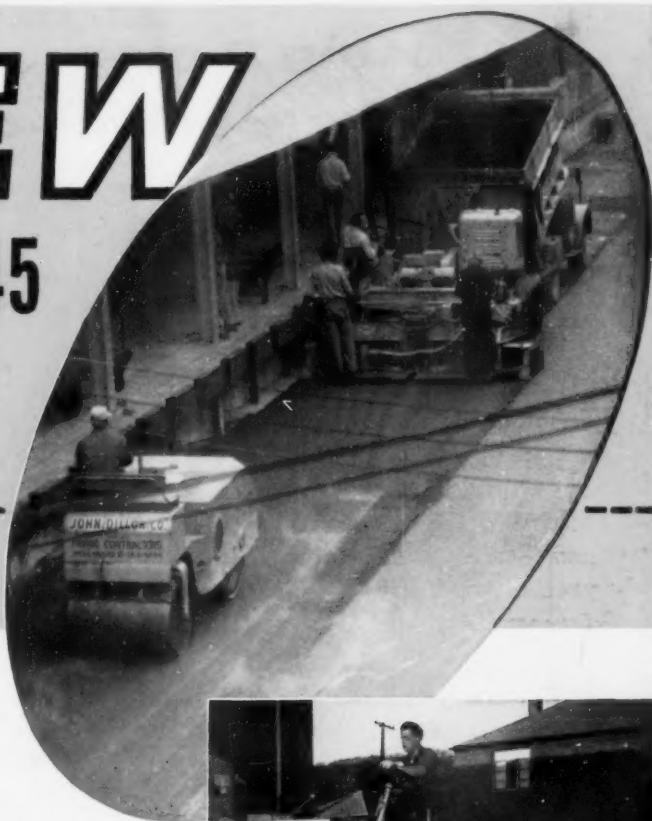
**GREATEST LOADS! BIGGEST HOPPER!
LOWEST LOADING HEIGHT! FASTEST CYCLE!**

NEW

BLAW-KNOX PF-45 Black Top Paver

gives you proved performance

Chicago Freight Yard. Limited clearance next to this loading dock would be a problem for other pavers but not for the PF-45. This smooth paving is laid over rough cobblestones.



Many hours of production on all types of small to medium size black top paving jobs in several cities have proved the profit potential of the Blaw-Knox Model PF-45. On numerous jobs where the PF-45 had to work in confined areas such as school yards, driveways and around freight loading docks its speed and maneuverability made fast work of what would ordinarily have been slow and costly hand spreading. Contractors who have used this Black Top Paver like its combination of self-power and its 4-ton hopper that allows it to work in tight areas. They also like its power to push big trucks and to give high travel speed which eliminates the need for trailoring the machine on short between-job-moves.

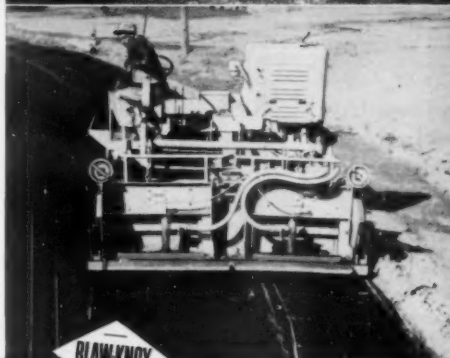
The combination of low investment and low operating cost assures owners of big savings on every small to medium paving job. The Blaw-Knox Model PF-45 incorporates many of the economy features of its big brother, the Model PF-90 which is designed for the larger paving jobs. Most important of these features is the combined rubber tire-mounting and floating screed action which eliminates deflection in paving surface. Plan on these economies on your paving jobs this season.

For complete information see Bulletin No. 2539. You can get it from your nearest Blaw-Knox Distributor or by writing direct to Blaw-Knox Company.

Pittsburgh Housing Area.
An areaway and playground would have had to be paved by hand since it required maneuvering in narrow driveways without damaging lawns and shrubs.



Cleveland Streets.
On this job the Model PF-45 proved it could handle street paving as well as work in confined areas.



BLAW-KNOX COMPANY
Construction Equipment Division
43 Charleston Ave., Mattoon, Illinois

Still using 2 men on this sewer-cleaning job?

The helper that was needed on this job to dump the bucket, is now released to handle other sewer maintenance problems. The Sewer Department has literally gained another man *at no extra cost.*

It's the new Automatic Bucket Dumper that does the trick. In 30 minutes, for less than 2 weeks wages, it can be installed on all existing "Flexible" Bucket Machines. And, of course, before any new Bucket Machines are purchased, you should get the full *Automatic Bucket Dumper* story.

FLEXIBLE INC.

3786 Durango Ave., Los Angeles 34, Calif.
(Distributors in Principal Cities)



To learn more about this latest in a long line of "Flexible" firsts, write for the name of your nearest distributor.

Handle Scores of Jobs with a **Wain-Roy** **BACK-HOE** ANY TIME — PLACE — SEASON

No piece of equipment gives you the versatility and economy of a Wain-Roy Back-Hoe mounted on a Payloader. It gives you a powerful back-hoe for hundreds of jobs, plus a versatile tractor-shovel for all types of excavation and material handling. Mounted on rubber, the unit travels and works on paved or unpaved surfaces and moves quickly from job to job without a trailer.

The Wain-Roy Back-Hoe gives you features no other hoe provides — long reach and digging depth; twin boom cylinders for more powerful break-out force and a more simplified, more dependable hydraulic system.

The Wain-Roy Back-Hoe is engineered to mount on Payloader tractor-shovels and International crawler and utility tractors. See your International Construction Equipment Distributor or write direct for more information.

Wain-Roy CORP. Dept. C
Hubbardston, Mass.



Right angle digging permits the handling of many types of jobs in close quarters and reduces interference with passing traffic.



Digging a vertical bell hole, quickly and economically.

Power-Transfer Differentials put

MORE PUSH in a PAYLOADER



more TRACTION means more PENETRATION

There's more punch—more push—more penetration with a "PAY-LOADER" because automatic power-transfer differentials assure better traction in adverse conditions—on loose underfooting, sand, mud, snow and ice. If one wheel slips, more power is automatically transferred to the opposite wheel, enabling a "PAYLOADER" to keep driving forward, where ordinary tractor-shovels spin helplessly. You get traction and *action* instead of wheel-spinning, time-and-power-wasting *inaction*.

These special, more-costly but more-effective differentials are but one of the many reasons why you get more tractor-shovel when you buy a "PAYLOADER" . . . why they dig more, carry more and deliver more yards per day than any comparable size tractor-shovel. You also get no-stop power-shift transmissions, planetary final drives, power-steer, 4-wheel power brakes, hydraulic load-shock-absorber . . . and you get the exclusive "PAYLOADER" bucket motion with 40° tip-back at ground level plus powerful pry-out action.

Your "PAYLOADER" Distributor is anxious to prove that a "PAY-LOADER" can out-perform anything in its class. He wants you to try one on *your* work and let *you* be the judge. Call him today!

Power-Transfer Differentials...

automatically direct the most power to the wheels that are gripping — whenever the other wheels tend to spin on mud, loose sand, ice, snow, etc.



PAYLOADER®

MANUFACTURED BY
THE FRANK G. HOUGH CO. LIBERTYVILLE, ILL.
SUBSIDIARY—INTERNATIONAL HARVESTER COMPANY



THE FRANK G. HOUGH CO.

761 Sunnyside Ave., Libertyville, Ill.

Send full data on 4-wheel-drive "PAYLOADER" units

<input type="checkbox"/> Model HO	<input type="checkbox"/> Model HH	<input type="checkbox"/> Model HU
2 1/4 yd. payload	1 3/4 yd. payload	1 1/2 yd. payload
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65

New!

TIME-~~S~~AVING COMBINATION LEAK DETECTOR-PIPE LOCATOR



THE M-SCOPE MASTER Electronic Witch Combination

You're looking at the much-talked-about **NEW M-Scope**... the only dual-purpose that detects leaks **and** locates pipe. Its rugged, highly efficient electronic circuit, plus ease

of use and portability, make this instrument one of the most welcome contributions to the water works industry.

Quick Facts



LOCATING A LEAK
AT THE VALVE



FINDING A LEAK
UNDER PAVEMENT



ONE MAN
OPERATION



LOCATING
A SERVICE

For greatest convenience and reliability, the M-Scope MASTER is equipped with a

built-in battery tester for instant checking of battery condition in the field or elsewhere.

WRITE TODAY FOR SPECIFICATIONS AND PRICE!

PIPE LINE EQUIPMENT
**JOSEPH G.
POLLARD
CO., INC.**
PIPE LINE EQUIPMENT

Place your next order with POLLARD

If it's from POLLARD... It's the Best in Pipe Line Equipment

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from WOODBRIDGE, NEW JERSEY . . . another report on HEIL Colectomatics



"Working a tough, 6-day week— no downtime in 8 months!"

**says Superintendent
Fred Modavis**

"Our Colectomatics are completely satisfactory in every way," reports Superintendent Fred Modavis, Department of Sanitation, Woodbridge, New Jersey. "Operating cost is very low and there has been no downtime except for routine service."

You'll find owner enthusiasm like this all over the country. Municipal officials will tell you that their collection crews are generous in their praise of the Colectomatic's performance. They like the fast, safe loading—the bulldozer packing action that gets more refuse into the body on every trip.

Let your own investigation convince you. Next time you're contemplating the purchase of new equipment, ask your Heil distributor for a demonstration of the Colectomatic. You'll see for yourself how the Colectomatic (13, 16 or 20-cu-yd capacity) can improve efficiency and reduce the cost of refuse collection services in your community.

THE HEIL CO.

MILWAUKEE 1, WISCONSIN

Factories:
Milwaukee, Wis.; Hillside, N. J.; Lancaster, Pa.

THESE COLECTOMATIC FEATURES SIMPLIFY REFUSE COLLECTION

- **BIGGER LOADS**
Bulldozer packing action compresses more refuse into body.
- **FAST LOADING**
Low, wide hopper sill allows two men to load side by side.
- **SIMPLIFIED SERVICING**
All lube points can be reached through doors on each side of body.
- **FAST DUMPING**
Flat floor, obstruction-free tapered body provide fast, clean dumping.
- **SAFETY**
Packing mechanism is completely enclosed. Safety door protects crew from flying debris. Load distribution on axles provides stability while dumping.
- **COMPACT BODY**
Allows better maneuvering when loading in narrow, restricted areas.
- **QUIET OPERATION**
No clanking chains, minimum truck engine acceleration while packing.

40 BLOCKS WEST
KERN & SON, INC.
QUALITY FURNITURE
KROEHLER

BLIGHTED...

W. W. WOLWORTH CO.

GOOD STREET LIGHTING CAN TRANSFORM a gloomy night shopping area into a safe, busy, cheerful symbol of community progress and prosperity.

40 BLOCKS WEST
KERN & SON, INC.
QUALITY FURNITURE
of KROEHLER

OR LIGHTED?

W. W. WOLWORTH CO.

Think urban renewal is just for big cities?

No, modernization of the "central city" section is not a problem for only the big metropolises. It's a problem that confronts *every* community which wants to keep its downtown section healthy and thriving.

A first step in checking "decay" in your business district is to determine if your public lighting system is up-to-date. For dark, uninviting streets reduce the hours of business, discourage visitors, and spawn accidents, delinquency, and crime.

Trade follows the light. Brightly lighted shopping streets attract out-of-town shoppers, as well as helping

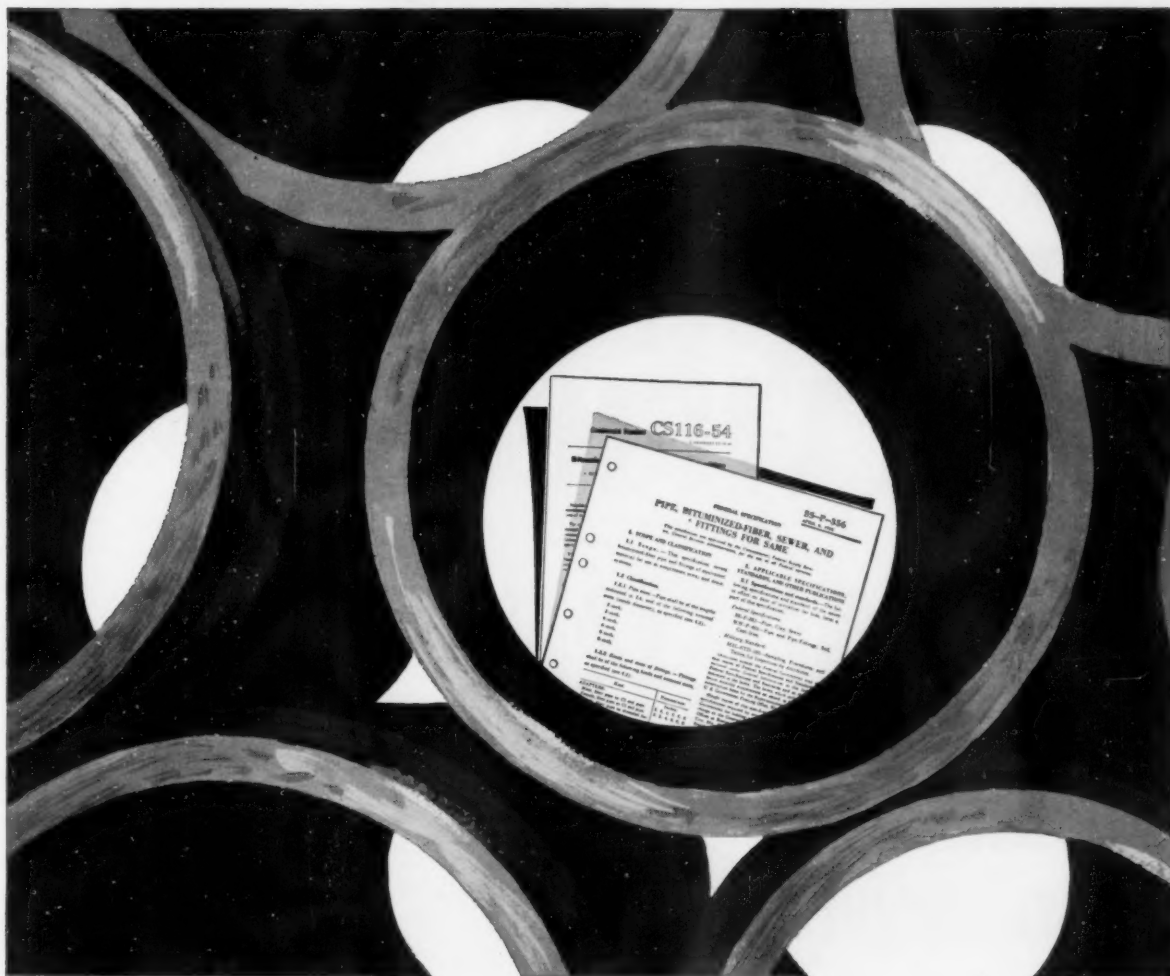
hold local customers. Real estate values stabilize, even rise, as the business pace quickens. Community pride and spirit soar as the shadows lift, setting the stage for further civic improvements. Good street lighting is contagious!

See your downtown section in a new light! No other major public works program you could sponsor can be achieved at such low cost, or in such a short time. Begin planning your relighting program—right away—with the help of your electric utility. General Electric Co., Schenectady, N. Y.

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**FOR CAT*
DIESEL ENGINES**

CATERPILLAR TRACTOR CO.
ENGINE POWER CERTIFICATION

This is to certify that the Diesel Engine herein described has been engineered, manufactured and tested in accordance with rigid Caterpillar Standards. The materials and workmanship incorporated into this engine give it the inherent capacity for satisfactory performance when applied in accordance with the power ratings established and recommended by this company. The **MAXIMUM OUTPUT** capacity of this standard production engine is **200 H.P. @ 2000 R.P.M.** equipped with: air cleaner, water pump, lubricating oil pump, fuel pump, and standard intake and exhaust manifolds.

I certify that B. I. Henson, Supervisor of Diesel Engine Test, Caterpillar Tractor Co., has tested this engine and I affix my signature and seal hereon this 18 day of February, 1957.

B. I. Henson
Supervisor Diesel Engine Test
Caterpillar Tractor Co.
Peoria, Illinois

_____ was manufactured and shipped as follows: Engine Serial No. 39B1018 Shipping Date February 11, 1957

Caterpillar Model D326 Industrial Power Rating _____

Power Setting 152 H.P. @ 1600 R.P.M. Intermittent

_____ Radiator & Fan _____ Tachometer Drive _____
_____ Ether Starting Aid _____ Muffler _____
_____ 32V Charging Generator _____ Heater Connections _____
_____ Governor Control _____ Remote Shut-off _____

POWER RATINGS

MAXIMUM OUTPUT is the horsepower capacity of the engine, a measure of the maximum power, $\pm 3\%$, that can be developed for five minutes without drop in speed.

INTERMITTENT HORSEPOWER is a rating for use in variable load applications such as excavators, hoists, and standby power units, where the duration of sustained full power output is one hour or less, with the average output not over 80% of Intermittent Horsepower.

RATED HORSEPOWER is a rating for use in applications such as planing mills, hammer mills, and rock crushers where the duration of sustained full power output is 12 hours or less.

CONTINUOUS HORSEPOWER is a rating for use in applications such as work-boats and pumps where the duration of sustained full power output is 24 hours per day, day-in-day-out.

Horsepower figures are established in accordance with rigid Caterpillar standards. All ratings, corrected to sea level barometric pressure (29.92 in. Hg.) and standard temperature (60°F), apply to a production engine including air cleaner, water pump, lubricating oil pump, fuel pump and standard intake and exhaust manifolds. The above ratings are based on British and American BHP.

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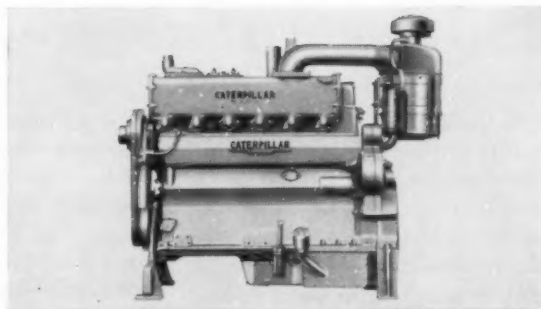
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In a quarter century of diesel leadership Caterpillar Engines have achieved a reputation for *honestly rated power*. Owners have found that they can depend on a Cat Diesel to deliver the power promised.

Now, to back this reputation, Caterpillar becomes the *first* manufacturer to issue a certificate showing the horsepower capabilities of the engine. This certificate is signed by Caterpillar Tractor Co. and certified by a notary public.

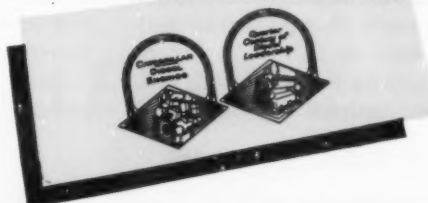
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KEEPING SIGNS

and

PARKING METERS

in Top Shape



GUY BROWNING ARTHUR

ATLANTA has a unique system of inspecting and servicing parking meters, and a first class sign manufacturing division, too. Both are characteristic of the resourcefulness and ingenuity displayed in the Traffic and Engineering Department, of which Karl A. Bevins is Director. Both departments are housed in a new shop building that has now been occupied about six months.

The shop is a "U" shaped building with a long central stem, and end wings projecting toward the street, making a parking area in front. Besides the meter and sign sections there are areas for carpenter and paint shops, and service functions. Just inside the entrance is a comfortable lounge with a coffee making appliance.

To the right of the entrance is the meter shop, which is something of an innovation in compact layout for its work. Along the outside wall are seven work benches, for the seven servicemen, each by a large window. At each bench, on the wall, there is a revolving rack of small jars containing screws and small parts. There is an extension desk lamp, and also another arm holding a 5-in. magnifying lens for examining parts for wear. A drawer in

each bench contains the small tools needed for meter repair. On the inside wall there is a complete installation for cleaning meters with solutions in the several tanks, provision for boiling and spinning, and a bench drill press. All the units are electrically driven and controlled.

A complete stock of parts is carried in a stock room on the right, through a door which is kept locked. New meters, and meters which have been renovated and ready to be put back on heads, are stored on steel shelving.

Servicing Meters

The efficient shop makes the complete servicing of meters possible, in a system which insures perfect operation of meters on the street.

There are seven servicemen, patrolling the seven territories into which the city is divided, who inspect 3354 meters on the street. For each man there is a complete book, with an index listing every meter by number and its location. There is an individual sheet for each section of the man's "beat." For some long streets two sheets are necessary. On the street map, arrows show the

man's course to cover. The average per man is about 500. He walks the entire course every day in a five-day week, tests every meter, and makes a report on it.

On the street map each meter is numbered to correspond with the number in the index. "BS-80" means an 80' bus stop. Truck areas are cross-hatched. In the lower right hand corner is recorded the number and length of yellow curbs, the number of meters, the number of truck spaces and their length, and the number of cross-walks.

The report form, which the serviceman makes out every day has columns for defects, time and adjustments made. In the column headed "Defects" are some of the headaches of the serviceman, indicated by abbreviations, such as "JC" meaning jammed coin; slug is slug in any coin operated machine; "BC" is bent coin; "wood" means that someone tried to work the meter with a piece of wood; and "PP" means trouble with pennies.

In a recent year the report on maintenance gives a good run-down on the troubles than can overtake a parking meter: Heads replaced 19;

PUBLIC WORKS

MAGAZINE

Vol. 88, No. 5 May, 1957



posts re-set or straightened 594; timers replaced 584; coin mechanism damaged 296; adjustments to timing mechanism 252; mainsprings damaged 58; broken windows repaired 174; jammed coin, slot or mechanism 8,142; meters cleaned 546; and others 418.

The serviceman noted the license numbers of the cars standing where a bent coin and a slug were found in the meters. These car numbers are recorded in the shop, and if the same cars are again found at meters which have been operated improperly, the car owner will be asked "why?" by a police officer. A person tinkering with meters or operating them with "queer" can be made very uncomfortable in Atlanta.

There was a series of "break-ins" in one section of the city. Some person used a heavy wrench to break off the meter heads, evidently to get at the coin boxes. After he had wrecked the first one he should have found that the coin box is in the bottom where it cannot be reached so easily. But he went on breaking heads until he was caught. In jail, now, he has time to meditate, perhaps to realize how little he could get out of parking meters.

Most cities collect the money from meters with their own employees, but in Atlanta it is made doubly hard for petty thieves by having an armored express company do all the collecting, depositing the "take" in a bank, and making detailed reports to the Traffic and Engineering Department.

Meter Repair

Each serviceman goes to his section of the meter map in a car or truck. He has with him meters which he can install where he finds one that cannot be adjusted or repaired on the street. A faulty meter is brought back to the shop at the end of his course. Any which he brings in are set up on his work bench, and are repaired and adjusted in the afternoon. No meter is set aside, and none is put on the shelves until it is working perfectly. This may mean dismantling, cleaning, boiling out, and thorough examination under the magnifying lens. Worn gears and levers are replaced with new ones. When the meter goes together again it is oiled and adjusted, as good as new.

No meter wears out, they say in this shop. The head is composite metal, and it takes no wear. The mechanism inside can always be put in top condition. There is nothing about it which cannot be restored

to good working order. And the trick is to do it immediately.

Like most cities, Atlanta used to get its new meters on a contract with the supplier, who required a 50-50 cut on the revenue to pay the bill. Now the city buys all new meters outright, and puts each one through tests in the shop before it is stored for use when needed.

Sign Making

The Sign Manufacturing Division serves Atlanta, a city of 350,000, perfectly, making between 4,000 and 5,000 signs each year. Formerly the city bought enameled steel signs, and had to store so many kinds and sizes that the storage problem became too difficult. About the time the new shop building was projected the city was changing to aluminum signs, and when this idea was worked out completely it reduced the storage space so that it could be

fitted into a comparatively small and compact shop. Now the entire stock of aluminum blanks is carried on two-and-a-half racks. The department now buys aluminum blanks in 11 different shapes and sizes, which make many different signs. The 12" x 18" blank makes 38 different signs; and special signs can always be made up from one blank or another.

The two important operations in making aluminum signs are putting the Scotchlite sheeting on the aluminum blanks, and printing. The reflectorized sheeting is applied by vacuum, the applicator taking blanks up to 6 by 4 ft. The silk screen process is used; also a Mono-Printer, which has its purpose in the overall job of making signs. The top is used as a work table. The space beneath, neatly partitioned, is for storing silk screens for different letters of the alphabet. The legend



● SILK screen printing process for making signs. Mono-Printer is shown at the left. Several completed signs are shown drying on a wire frame in the foreground.



● **METER** maintenance shop equipment is complete, with provisions for cleaning meters, and for replacing worn parts, oiling and adjusting to original condition.

on a sign is made by printing one letter at a time from the silk screens. Letters up to 12 ins. high can be made.

Street Signs and Markings

Six crews work out of the sign shop. Two are on truck mounted equipment for marking lines on streets; and in Atlanta this marking is carried beyond the practice in most cities. Most of it is done with a Model D striping truck. The total

of this work is about 192 miles of center and lane lines to be worked over and over as the lines need to be changed or renewed.

These two crews cannot work outside in inclement weather, so they come into the shop and make signs. One works on the preparation of metal and putting on the Scotchlite sheeting, and the other takes over the silk screen printing frame.

The other four crews do all other work on the streets in connection

with marking, such as erecting signs, changing them and straightening posts; painting yellow curbs, parking space lines, no-parking areas, posts, and miscellaneous jobs. They can stay out in almost any weather, but when it gets too bad they find work to do in the shop.

The scope of the maintenance of signs gives a good idea of what sign making and placing means in a city of 350,000. In a recent year in Atlanta this was the record of installations: Stop signs 534; Yield Right-of Way 55; Slow 79; Parking 1,932; One Way 200; No Left Turn 41; Loading Zone 143; Do Not Block Driveway 28; Dead End 53; Keep Right 110; Emergency, No Parking 1,800; Speed Limit 338; School Zone 39; Children Playing 173; Others 326; total installed 5,951; total signs manufactured 4,695. The number of markings made by street crews for this same year was: Crosswalks, intersections 390; Crosswalks, mid-block 43; Truck loading zones 321; No parking, yellow curb 89,751 lineal feet; Center and lane lines 175.1 miles; and Parking spaces 3,112.

The quality of the signs made here is superior to the general run found in most cities. An observer will note that they are always on good posts, painted from top to bottom, and that they are well placed on sight lines for motorists and pedestrians. They get attention because they are clean and bright.

Color combinations vary with requirements. The Scotchlite background is best for night warnings. Red letters on a white or silver background is found good for many signs, and other colors are used for a wide variety of purposes.



● **METER** servicing: Benches are provided with good light and with 5-inch lens for examining small parts for wear.



● **SIGN MAKING:** Press cements Scotchlite sheeting to aluminum sign blanks as described in the text herewith.

AUTOMATIC GRAVITY FILTER OPERATES WITHOUT VALVES

A NEW ENTRY in the field of water filtration equipment is a gravity type filter that uses simple hydraulic principles to control the entire filter operating cycle. All valves are eliminated, yet the filter backwashes automatically whenever the head loss reaches a predetermined figure, and returns itself to service after the backwash and rinse are completed.

Called the "Automatic Valveless Gravity Filter", it was displayed by the Permutit Company at the 1955 AWWA Convention. The first commercial installations were made over a year ago, and a number of units now are in operation.

Generally two or more of the filters are arranged to receive effluent from the pretreatment units, which may be upward-flow tanks or chemical mixing and flocculation followed by sedimentation tanks. In the installations of the valveless filter made to date, Permutit "Precipitators" were used for pretreatment. In any case, treated effluent is discharged to the filters at a uniform rate, and where more than one filter is in operation, the flow is divided equally among all the filters that are on the line by means of a splitter box or similar device.

Operating Cycle

The method of operation can be followed most easily by reference to the accompanying diagrams, which show flow paths for each step in the operating cycle. Considering a single filter, and starting at a time when the backwash has just been completed, the cycle proceeds as follows:

Filtering—Water flows at a constant rate from the inlet pipe into the chamber immediately above the sand, and then passes down through the sand and the strainers set in the false bottom. From this lowest chamber the water passes upward through ducts leading to the storage chamber. The first water through the bed following backwash serves as a rinse. Flowing from the lowest chamber, the water passes upward through ducts to the

backwash storage chamber, and thus serves as supply for the next backwash. No water goes to service until the rinsing operation has filled the wash-water storage compartment. Both the top of the tank and the top of the outlet pipe are open; hence the water maintains the same level in the storage tank and outlet pipe. Eventually the water level reaches the horizontal run on the outlet pipe and the entire flow of freshly-filtered water passes through the outlet to service.

As the run progresses the head loss increases across the sand bed. This is reflected in rising water levels in the inlet pipe and in the backwash pipe proportional to the loss of head in the filter. When the loss

in head reaches the predetermined figure for the end of the filter run, the rinsing water runs over into the downward section of the backwash pipe and initiates the backwashing operation.

Backwashing—The backwash pipe is sized to carry about six times as much water as the inlet pipe. As a result, when this pipe discharges, water is drawn from the storage tank down through the ducts and up through the strainers, expanding and cleansing the bed and discharging the backwash water to waste.

When the water level in the water storage tank drops below the end of the siphon breaker, air enters and stops the backwash. The flow in the filter bed then reverses



● AN INSTALLATION of the new filter. Shut-off valve shown takes filter out of service; an adjustable weir in flow splitter box can eliminate this valve, too.

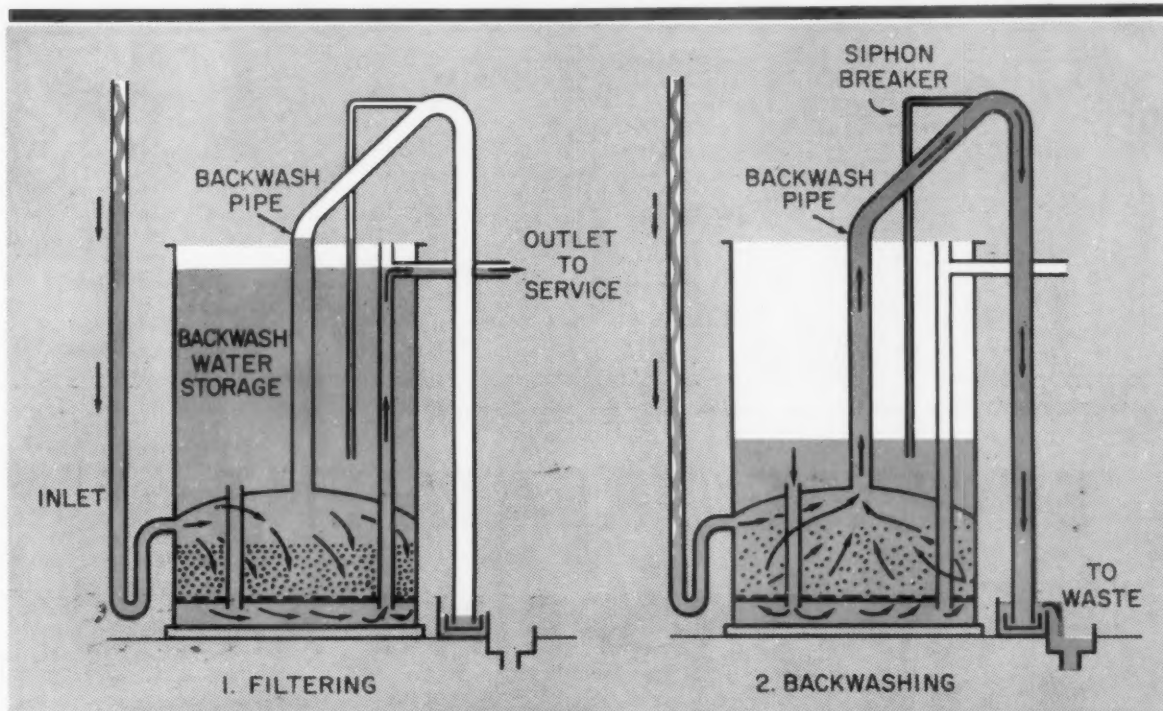
and influent water again flows down through the filter, automatically rinsing the bed. At this point the cycle starts over again, with the rinse water rising to the storage tank to provide backwash water for the next cycle.

Since each filter unit stores its own backwash water supply, any number of units can be backwashed at one time, with the only limitation

and used to wash the bed. The available head is higher at the start of the wash than at the end of the wash due to change in elevation in the storage tank. This provides the most vigorous wash at the start and a more gentle wash at the end. With the gradually reducing rate the sand is hydraulically graded as it settles back in place. The backwash period takes about 3½ minutes to com-

between washes will increase proportionally.

The simplicity of the design offers many savings in initial construction costs. Though the capacity of an individual filter is limited in size, the lack of costly valves and piping permits the installation of a larger battery of units than would be economically feasible with conventional filter designs. This is an important



● WATER LEVELS and path of flow are diagrammed during the filter run (1) and near the end of the backwash (2).

being the capacity of the waste water sewer. No washwater pumps are required.

Construction Details and Flow Rates

The elevation of the backwash collector pipe above the top of the filter tank determines the head loss to which the filter will operate. This is usually selected at four to five feet. The backwash rate is controlled by a regulator bucket set at the outlet end of the backwash pipe.

As noted above, the backwash pipe carries about six times as much water as the inlet pipe. The input water flows at a rate up to three gallons per square foot per minute. This flow is constant throughout the entire filtering, washing and rinsing cycle. During the backwash period, water at an average rate of 15 gallons per square foot per minute is withdrawn from the storage tank

plete. Rinsing and refilling of the wash storage tank takes approximately 15 minutes. At present, valveless filters can be provided in sizes up to 10 feet in diameter. At a filtering rate of 3 gpm per sq ft., the largest size unit has a capacity of about 230 gpm.

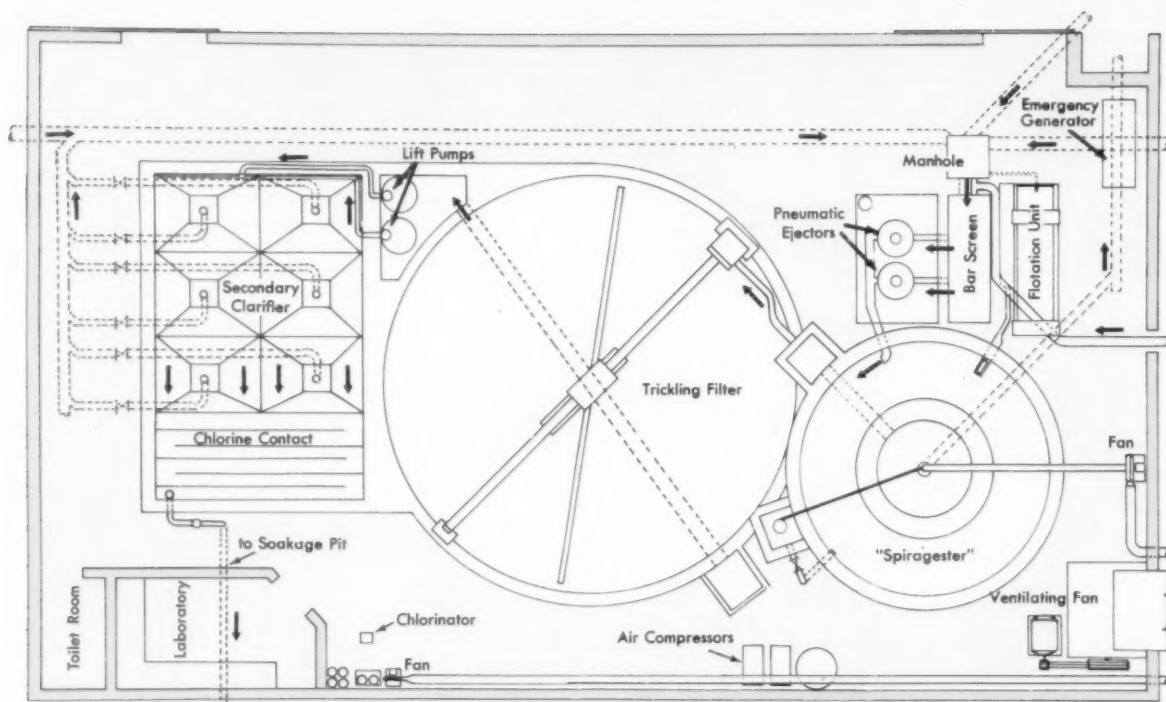
Advantages

A number of advantages are provided by the automatic operation of the valveless filter. When the filter needs washing, it washes automatically. Overruns that may result in negative pressures in the filter bed are eliminated, so there is no danger of air binding or the formation of mud balls brought on by continued operation of a dirty filter bed. Similarly, there is no danger of wash water waste due to backwashing at too frequent intervals. If the turbidity load on the filter is lightened, the length of time in service

consideration in many communities where water demands have been increasing rapidly and promise to continue to rise in the future. The simple pipe connections of the valveless filter make it possible to design a filtration system that can be expanded readily to meet future needs.

Another factor that may be of advantage in plant design is the location of the outlet pipe. In the case of the 10-foot diameter unit, this is about 14 feet above the floor level. Thus intermediate pumping may be eliminated.

To date all installations of the valveless filter have been for the treatment of industrial water supplies. However, the very first installation received approval of the Ohio State Board of Health, which was concerned because the plant supply was used for drinking water as well as industrial applications.



● SEWAGE TREATMENT plant for a new shopping center near Miami is housed in an underground room 46 by 80 ft. in size.

SEWAGE TREATMENT for SHOPPING AREAS

C. E. WRIGHT

TWO Florida shopping areas, one in Jacksonville and another of even larger size in Miami, are outstanding examples of privately built sewer systems in Florida, according to the Division of Sanitary Engineering of the State Board of Health. A unique feature of the Miami project is that its sewage treatment plant is underground in a room only 46 by 80 ft., which, due to equipment arrangement, leaves adequate service space. The treatment plant is located under the central plaza between two of the main buildings.

The Miami project, built at a cost of \$15,000,000 by Food Fair Properties, Inc., an affiliate of Food Fair Stores, is situated at 163rd Street between N.E. 12th and 15th Avenues, and has been occupied, or will be when all buildings are completed, by two department stores and many national chains. There are seven buildings, the central and largest three stories high and having

Two shopping centers in Florida provide their own modern sewage treatment. One of the plants fits in a small room under the central plaza.

130,000 sq. ft. of floor space. The total sales area of the entire center is 488,000 sq. ft.

In the Miami project the collection system does not extend beyond the limits of the property. The sewage is taken by gravity to the treatment plant level which is 14 ft. below the plaza. At the treatment plant sewage enters a manhole and passes through a bar screen to a 2½-ft. by 9-ft. sump. From the sump it is lifted to the treatment units by a pair of Shone pneumatic ejectors equipped with non-clogging check valves and driven by two Yeomans rotary air compressors with automatic controls. The capacity of the ejector is 80 gpm at each operation against a total discharge head of 20 feet.

Primary sewage treatment is by a Yeomans Spirahoff combination

clarifier and digester, with a tank diameter of 18 ft. and a depth of 16 ft. The floor of the clarification compartment is an inverted cone formed by the gas hood of the digestion chamber. A centrifugal pump is installed in the supernatant box for supernatant recirculation to the liquid surface in the gas hood.

A Gibbs flotation unit, model No. 10, is used for removing from the Spirahoff unit such grease as is not otherwise separated from the sewage before reaching the plant. It operates by constant recirculation from a skim line back to the lift station. Grease is removed in cans. Sludge from the Spiragester is conducted to a 6-in. pump-out valve under a loading platform in the underground truck service tunnel and is periodically removed by tanker. This was done because no space was

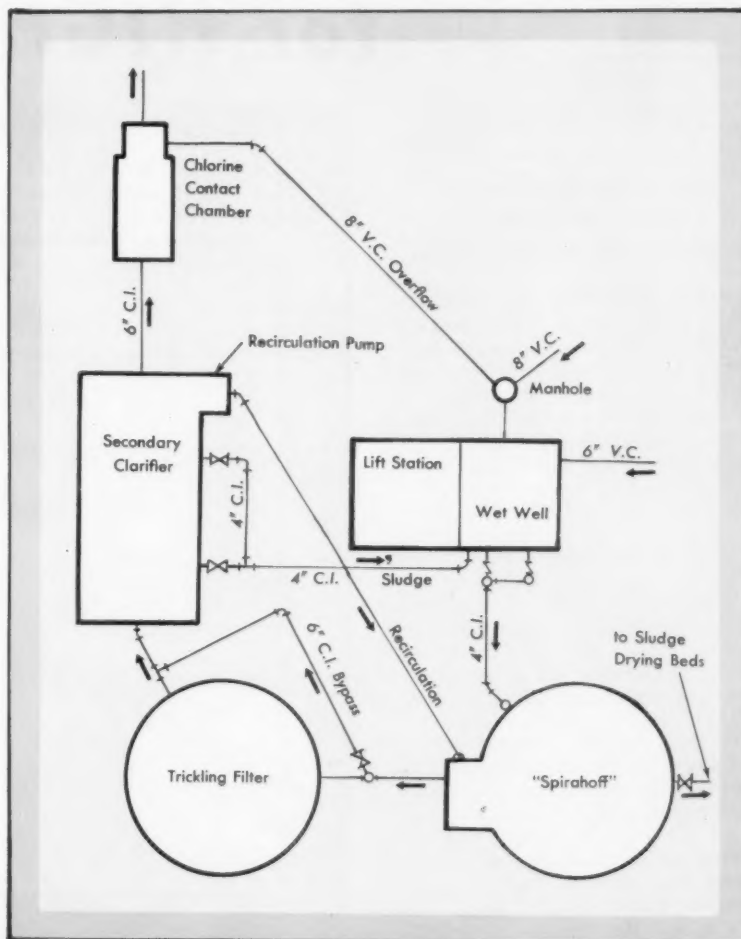
A Yeomans 30-foot diameter Water-wheel distributor applies sewage to the trickling filter, which has a 6-foot depth of media. During off hours recirculation is accomplished by cracking one of the final settling tank blowoff plug valves to provide a minimum flow to keep the filter active. The plant attendant goes off duty at 10:30 p.m. at which time the plant influent drops very close to zero. This method utilizes the lift units set up for basic operation; and also, if use of the plug valves is rotated, serves to return the final sludge to the primary sedimentation unit on a regular schedule.

Chlorination is by a Wallace & Tiernan solution feed chlorinator with a feed range of 0.8 to 25 lbs. of chlorine per 24 hours. The feed rate is automatically controlled by the flow meter through an A-625 rotary converter. The flow meter is of the recording type. Provision has been made in the design for a second point of chlorination.

The plant is designed for a flow of 60 gpm, with peaks of 100 gpm. Variation is down to nothing, as there is no residential occupancy.

The Arlington Plaza Shopping Center, approximately four miles East of the Jacksonville city limit line, is located near Arlington, which is a fast growing residential area. It will have 250,000 square feet of rentable floor space and will cost approximately \$2,500,000. It is being constructed by the Arlington Plaza Shopping Center, Inc., of Jacksonville, a Florida Corporation. There is planned a number of stores and offices including super-markets, auto parts, ladies apparel, 5 and 10-

The sewage collection system is comprised of 8-inch vitrified clay pipe, installed sufficiently deep to serve practically all of the adjoining businesses planning to use the system. The treatment plant comprises a lift station, Spirahoff combination clarifier and digester, a high rate trickling filter, secondary clarifier, chlorine contact chamber

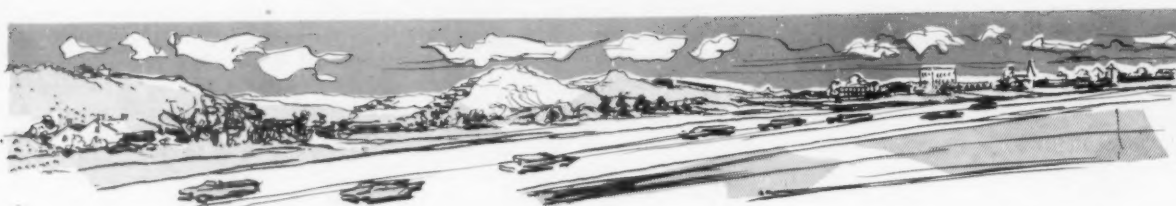


● **LAYOUT** of sewage treatment plant for the Arlington Plaza Shopping Center.

The owners and developers of the Shopping Center requested that the sewage treatment plant be overdesigned in order to accommodate the various small businesses surrounding the Shopping Center. This proposal was readily accepted by the County Health Authorities in that it would eliminate the necessity of numerous smaller plants being constructed in the area. Contracts will be entered into with approximately

The Spirahoff effluent flows by gravity to a high rate trickling filter 6 feet deep, equipped with a rotary distributor. The filter effluent flows to a secondary clarifier. The secondary sludge is removed to sludge hoppers and later drawn off and returned to the lift station.

On the secondary clarifier effluent there is installed a recirculation
(Continued on page 235)



SURFACE TREATMENTS for HIGHWAYS

FRED J. BENSON,

Executive Officer,

Texas Transportation Institute

and Vice Director,

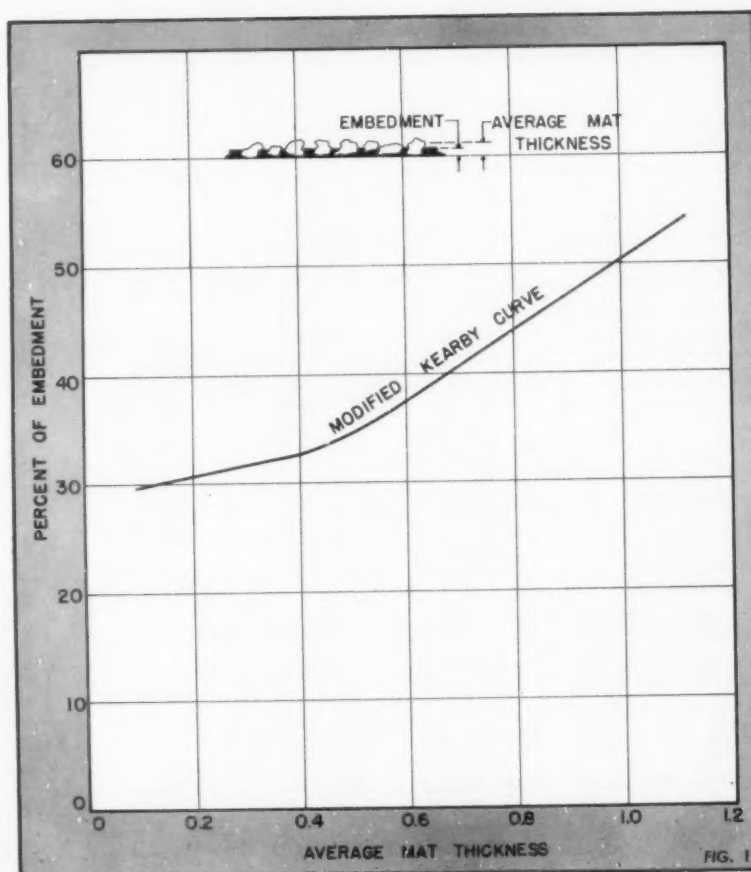
Texas Engineering Experiment Station

BECAUSE TERMS vary throughout these United States surface treatments, as here discussed, consist of an application of bituminous material followed by an application of aggregate on a prepared surface. If the process is repeated the resulting surfaces are referred to as double or triple surface treatments depending on the number of applications. A single surface treatment placed over an existing surface is commonly referred to as a seal coat.

The surface treatment is a most economical type of roadway surfacing and under favorable conditions may have a reasonably good life expectancy. One fundamental principle which must be kept in mind is the fact that a surface treatment has little structural value and hence is useful only when the underlying base course is strong enough to carry the traffic load. Two very essential functions of a surfacing can be accomplished with the surface treatment: (1) a waterproof layer; and (2) a non-skid surface with adequate resistance to traffic abrasion. In addition, the surface treatment can be used to liven up an existing bituminous surface. Since surface treatments can be produced in a variety of colors, dependent upon the color of the aggregate, they are also useful in providing color demarcation between different roadway elements.

Seal Coat Treatments

Aggregate Characteristics. Any reasonably sound aggregate such as gravel, crushed gravel, crushed stone, or crushed slag can be used



● PERCENT embedment and average mat thickness determine asphalt quantity.

successfully for surface treatments. In general the aggregate should be reasonably resistant to abrasion and a maximum Los Angeles abrasion loss of 35 is often specified. However, aggregates with losses up to 40 have been used successfully. The grading of the aggregate for surface treatments is important. The nature of the construction procedure is such that only one layer of aggregate can be stuck. The average surfacing thickness will then be dependent

upon the size of the aggregate. If the aggregate has an appreciable variation between the largest size particles and the smallest size a bitumen film sufficiently thick to hold the largest size may completely submerge the smallest size. For this reason the aggregate should be uniformly graded.

Generally the ratio of maximum to minimum size for a surface treatment aggregate should be 2:1 with a reasonable tolerance for oversize

and undersize particles to allow for economical commercial production. For example the specification for a 1/2-inch maximum size aggregate might be as follows: Passing 1/2" sieve 95-100%; and passing No. 4 sieve 0-5%.

In some cases it is possible to obtain surface treatment aggregates quite economically from scalping operations in concrete aggregates. As an example, a natural gravel may have an excess of the 1/2-inch to No. 4 size which is being scalped in the production of concrete aggregate and which will be perfectly satisfactory for use in surface treatments.

Shape of particle is of some importance in aggregates for surface treatments. Probably the ideal shape would be uniform cubical or pyramidal. A predominance of flat and elongated particles is undesirable. However, very successful surface treatments have been produced with aggregates having rather poor shape.

A very important characteristic of the aggregate is good adhesion between the aggregate and asphalt and the ability to retain this adhesion in the presence of water. The bitumen-aggregate contact is directly exposed to the action of surface waters, and stripping or loss of adhesion between stone and bitumen can be disastrous. Experience is the best test of this aggregate quality. The immersion-compression test (ASTM D 1075-54, Effect of Water on Cohesion of Compacted Bituminous Mixtures) is of value in predicting stripping characteristics.

Cleanliness is extremely important in surface treatment aggregates. If the aggregate at the time of placement is dusty or coated with silt and clay, adhesion problems will occur. When dusty aggregate is placed the dust produces a film over the surface of the bitumen which will prevent adhesion of the aggregate.

Wet aggregates do not adhere as well as do dry aggregates and the ideal situation is to place a hot, dry aggregate. Field conditions are generally such that cover aggregates will contain some moisture and their use in this condition therefore is often necessary. The presence of moisture in the aggregate is detrimental to adhesion but presents no serious field problem when the work is accomplished in warm dry weather which promotes rapid drying. There is some evidence that dusty aggregates give better results when placed damp than when placed dry. The dust is bound to the stone surfaces and thus does not tend to form a film over the surface of the

bitumen. For this reason many field men when faced with the necessity of using dusty aggregates wet them down before application.

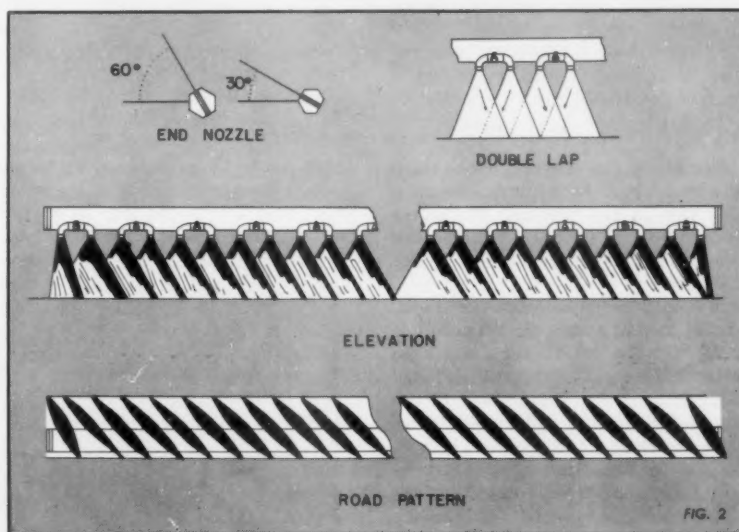
A recent development in surface treatment aggregates is the use of precoating. Precoating is the process of placing a very thin film of bitumen on the aggregate prior to its use. This solves the dust problem almost entirely and also guarantees good adhesion of the aggregate to the bitumen. The precoating adds to the cost of the aggregate but the additional cost is often justified by the better results obtained.

Aggregate Quantity. The quantity of a given aggregate for single surface treatments and seal coats can be determined most easily by direct trial. An area one yard square is laid off on any reasonably smooth surface; a piece of plywood is excellent. A representative sample of the aggregate is then spread over the area so that it covers completely one stone thick. The aggregate required is then recovered and weighed. It is well to average three trials, and use the resultant value hereafter referred to as the "spread quantity."

yard area and it is found that 18.3 lbs. per sq. yd. are required to cover. The loose unit weight of the aggregate is 94 lbs. per cu. ft. The field quantity would then be 18.3 (1.1) or 20 lb. per sq. yd. (Since the method is not precise, quantities to the nearest pound per square yard are used). The corresponding volume relationship would be $27 \times 94 \div 20$ or 127 sq. yd. of surface per cu. yd. of aggregate.

Average Mat Thickness. The average thickness of the aggregate in the mat can be determined from the spread quantity and the loose unit weight. This calculation assumes that the particles will have the same arrangement in the one-stone spread as in the container when determining loose unit weight. This is undoubtedly not true, but the calculation does provide a good measure of average mat thickness and this mat thickness is useful for determining the proper quantity of bitumen.

Considering the same aggregate as in the previous example, a mat one inch thick would require $3 \times 3 \times 94 \div 12$ or 0.75 x 94 lb. per sq. yd. Hence the average mat



● SPRAY bar setting of distributor showing end bar arrangement and double lap.

Since there will be some loss of aggregate due to spreading inaccuracy and the failure of all particles to adhere, it is good practice to add an additional ten percent to cover these contingencies. This adjusted quantity is then used for the field application. If it is desired to determine quantity on a volume basis the loose unit weight of the aggregate must also be determined. As an example suppose that a given aggregate is placed on the square

thickness for the 18.3 lbs. per sq. yd. spread quantity is $18.3 \div (0.75 \times 94) = 0.26$ in.

Bitumen. A wide variety of bituminous materials can be used successfully for surface treatments. There are two essential requirements of the material. When the stone is applied initially the viscosity of the bitumen must be such that the stone is held by the bitumen; in other words good wetting of the stone by the bitumen must



● SEAL COAT treatment of local road is shown here. Application was 0.3 gallon per square yard of 120/150 penetration asphalt. Shot was started on paper sheet.

occur. This requires a reasonably fluid bitumen. Secondly, when adhesion has been attained the bitumen must hold the stone tightly against the tendency of the traffic to dislodge it. This is best accomplished by a fairly hard bitumen.

The ideal bitumen for surface treatment should be initially fairly fluid to allow time for placing of the stone and then revert to a harder condition rather rapidly to hold the cover aggregate firmly. The cutbacks with a highly volatile cutter stock and the emulsions most nearly satisfy these requirements. Likewise in hot weather the softer semi-solid bitumens which are heated for application are quite satisfactory.

In asphaltic materials the rapid curing cutbacks in all grades, the rapid setting emulsions, and the softer (120 to 300 penetration) asphalt cements are best suited. In the tar materials the intermediate to hard grades (RT-6 to RT-12) and the tar-cutbacks are most successfully used. The medium curing cutbacks have been used for surface treatment work; they satisfy the first essential of being sufficiently liquid for good initial adhesion, but the kerosene cutter-stock evaporates so slowly that the stone is not tightly held for some time so that opening to traffic is unduly delayed. The medium-curing cutbacks may be useful under exceptional circumstances when work is done in cool to cold weather.

Quantity of Bitumen. J. P. Kearby, Senior Resident Engineer of the Texas Highway Department, set forth a procedure for determining the quantity of bitumen on the basis

of proper embedment of the aggregate. Subsequent work in the laboratories of A. and M. College of Texas verified Kearby's conclusions. Figure 1 shows the required percentage of embedment in the bitumen for aggregate of various sizes based on the average mat thickness previously discussed. From Figure 1 note that the proper embedment for the stone with a mat thickness of 0.26 in. is 32 percent. This means that, on the average, the bitumen should cover the aggregate up to 32 percent of its depth.

It is necessary to know the average mat thickness, the loose unit weight, and the specific gravity of

the stone (specific gravity may be estimated if not accurately known). The quantity of residual bitumen required to fill the area not occupied by the stone (void area) can then be computed. As an example consider the aggregate having an average mat thickness of 0.26 in., a unit weight of 94 lb. per cu. ft., and a specific gravity of 2.64.

$$\text{Depth of bitumen} = 0.32 \times 0.26 = 0.083 \text{ in.}$$

$$\text{Cubic foot of bitumen per square yard} = (3 \times 3) (0.083 \div 12) [1 - (94 \div 2.64 \times 62.4)] = 0.027 \text{ cu. ft.}$$

Gallons of bitumen per square yard = $0.027 \times 7.5 = 0.20$. When the bitumen used contains appreciable volumes of cutter-stock or water which will be dissipated by evaporation the quantity of bitumen should be increased correspondingly. For example, if an emulsion containing 70 percent asphalt is used the quantity applied should be $0.20 \div 0.70 = 0.29 \text{ gal. per sq. yd. of emulsion.}$

This method is straightforward and takes care of variations in aggregate with essentially the same grading. The embedment percentages shown have been successfully used in the Southwest where bleeding during hot weather is the primary problem. For colder climates somewhat greater percentages of embedment are probably warranted. In a given area the proper embedment percentage can be determined from the quantities used for a few successful jobs.

The above calculation for bitumen quantity is based on the as-



● AGGREGATE should be spread immediately after the bitumen is placed for best results. Methods of determining the aggregate required are described in the text.

sumption that none of the applied bitumen is absorbed by the roadway surface. This will be true for freshly primed surfaces and for existing rich bituminous surfaces. Where the surface itself will absorb bitumen, the quantity which will be absorbed must be estimated and added to the quantity required by the aggregate. This absorbed quantity will ordinarily be from 0.02 to 0.05 gal. per sq. yd. for normal surfaces but may rise to 0.10 to 0.15 gal. per sq. yd. for badly cracked surfaces or unprimed base courses.

In like manner bitumen may be absorbed by porous aggregate and this will require some adjustment in quantity. For the usual hard gravel and crushed stone, absorption will not be a problem. For slag and some crushed stone absorption should be considered. Ordinarily the allowance for absorption will be in the range of 0.02 to 0.07 gal. per sq. yd., hence it is not ordinarily necessary to make a precise determination since the percentage effect of a sizeable error in absorption on total bitumen quantity will be small.

Construction Details

Preparation of Surface. New surfaces must be thoroughly compacted prior to the application of a surface treatment. The base course must be capable of carrying the traffic loads and structural adequacy should be insured prior to surfacing. It is good practice to place a prime coat on a new surface; a prime coat will promote good adhesion of the surface to the base and eliminate absorption of bitumen into the base. If the surface treatment does not follow closely after the prime the surface should be cleaned.

Existing bituminous surfaces should be patched and cleaned by brooming prior to the application of a seal coat. A seal coat cannot be used to level existing surfaces.

Applying Bitumen. One of the most important requirements for good seal coats and surface treatments is the application of the bituminous material uniformly at the desired rate. Modern distributors, properly operated, will do a good job. The speed of the distributor should be measured by a fifth-wheel tachometer. The tachometer should be checked by operating the distributor over a measured course of at least 1000 feet at the intended speeds of application. If the distributor does not have a properly certified calibration, it should be calibrated by filling in ten-gallon

increments while in a level position and determining the liquid level for each increment. The distributing interior should be examined to make sure that it is clean and that no coke or scale has accumulated on the fire tubes. The nozzles should be inspected for damage and thoroughly cleaned prior to beginning operations. Careful attention must be given to the nozzle settings so that fans do not interfere with each other and the spray bar must be set at the proper height to give proper lap. Double lap coverage and a common method of setting nozzles are shown in Figure 2. The manufacturer's recommendations for proper operation of the distributor should be care-

line. Wherever possible the entire width should be covered in a single application in order to avoid the necessity of matching shots longitudinally.

One other important factor, often overlooked in applying bitumen, is the necessity of having proper viscosity at the time of application. The proper viscosity for application is the subject of some difference of opinion with values of 40-60 and 30-100 seconds Saybolt Furol at the nozzle being quoted. If a value of 50-60 seconds be chosen the temperature at which a given material should be applied is fixed. There are appreciable variations in the temperatures at which different materials meeting the same specifica-



● SELF-propelled aggregate spreader is distributing seal coat aggregate. Use of a tachometer for maintaining uniform spreader speed has proved advantageous.

fully followed. The distributor bar height is properly set with the distributor full. Then as the distributor is emptied the spray bar will gradually rise so that it is impossible to obtain exactly similar coverage throughout the entire shot unless a dolly is provided to maintain a uniform spray bar height.

Applications of bitumen should begin and end on paper in order to obtain straight joints without overlapping application. During actual shooting operations each fan should be a solid sheet of asphalt from the nozzle to the roadway surface. This can be obtained with proper nozzle size, proper pump pressure, and proper distributor speed. The total length of the shot should be adjusted to that which can be covered promptly with cover aggregate. A string line placed along the side of the road is used to guide the distributor operator; the engineer should establish a nail line about 2 feet outside the area to be surfaced as a guide in setting the string

tions reach this viscosity. As an example the temperature required for a viscosity of 50 seconds Saybolt Furol varies from 268° to 325° F. for the 210-250 penetration asphalt cements commonly used for surface treatments in Texas. Field engineers placing surface treatments should obtain viscosity-temperature curves for the materials being used.

Application of Aggregate. It is also important that the aggregate be spread uniformly and at the proper rate. To spread aggregate truck-pushed spreader boxes and self-propelled spreaders are employed. The use of a tachometer to maintain uniform spreader box speed has proved highly successful on some jobs. In the event that excess aggregate is placed in some areas it should be removed with a square end hand shovel. Additional aggregate should be cast on areas where the application is insufficient. Distribution rates can be closely controlled by laying off the length which each truck load should cover.

Application of the aggregate immediately after the bitumen is placed is necessary for good results. This is particularly true where semi-solid bitumens and emulsions are used. All of the aggregate necessary to cover a distributor shot should be on hand at the time the bitumen is placed and placement of the aggregate should begin just as soon as possible after the distributor is started. Aggregate placing lanes should lap about 6 inches to secure complete coverage.

Rolling. The purpose of rolling is to seat the aggregate in the bitumen and thus develop the bond between aggregate and bitumen which is necessary to resist the traffic stresses. Both flat wheel and pneumatic rollers have been used successfully. There are differences of opinion as to which roller is the best, but it has been shown that good jobs can be accomplished with either roller or any combination of both rollers. Some engineers recommend initial rolling with a flat-wheel roller followed by the pneumatic roller while others follow just the reverse procedure. The important requirement is early and adequate rolling. Since only one layer of aggregate is involved light rollers should be used.

Broom dragging to spread the aggregate should not be permitted before initial rolling, as it tends to shift the smaller particles to the bottom and prevent adhesion of the larger particles. After initial rolling the broom drag may be used to distribute loose aggregate and promote maximum retention. The broom drag must be operated quite slowly, 4 miles per hour or less, in order to prevent bouncing which leads to an undesirable rhythmic surface roughness. During warmer weather, broom dragging and rolling may be continued, during the heat of the day, for several days with beneficial results.

Removing Excess Aggregate. Aggregate which does not stick creates a problem, since fast moving vehicles will pick up the loose particles in their tires and throw them against following vehicles often damaging headlights and windshields. This aggregate may be removed after all rolling is completed by lightly brooming with a rotary broom during the cool of the early morning. This operation must be performed with care so that the bond of the stuck aggregate is not broken.

Weather Conditions. Surface treatment and seal coat work ordinarily should be carried on only during the warm season of the year. When the bituminous material is applied to a roadway, it approaches the temperature of the surface in a very short time. Since the viscosity of the bitumen when the aggregate is applied is very important in wetting and adhesion, it follows that difficulty can be expected when the surface is cold. Ordinarily such work should not be carried on when the temperature of the surface to which the bitumen will be applied is below 50° F. Dry surfaces are also essential for good work, hence work should not be carried on in wet weather.

Should it become necessary to perform work in cold weather best results can be secured with the thinner bitumens and relatively light cover. Applications of RC-1 covered with coarse sand are quite good for seal coats during cold weather. Heating the cover aggregate is a helpful expedient for cold weather work as the hot aggregate softens the bitumen and thus adheres better. In most cases heating is not practical and it adds materially to the cost.

Multiple Surface Treatments

When greater thickness of mat is desired on new construction, with-

out the tire noise due to the use of a single large aggregate, double and triple surface treatments may be used. This type of construction will produce surfaces with thicknesses up to about 1½ inches which, if placed on a good base, can carry rather large traffic volumes for periods up to 10 to 15 years.

When multiple applications are used, it is essential that each succeeding aggregate nest with the layer previously placed so that the completed construction will form a nearly compact mass with a dense, tight surface. The success of this type of construction depends upon this nesting of the particles and the redistribution of the bituminous material through the mass. The largest size aggregate is placed in the lower course with succeeding courses using smaller aggregate. A good general rule is that the second course aggregate should be about half the size of the first course aggregate, and the third course aggregate about half the size of the second. As an example, if the first course aggregate is predominantly 1-inch to ½-inch in size, the second course should be ½-inch to ¼-inch and the third course ¼-inch to ⅛-inch (No. 6 sieve). The total thickness, using normal aggregate, for a double surface treatment with the first two aggregates would be about 1½ inches and for a triple surface treatment using the three sizes about 1¼ inches. With large percentages of flat particles in the aggregate thicknesses would be less.

The quantity of each size of aggregate for a multiple surface treatment is that quantity required to cover one stone thick. This spread quantity should be determined in the manner outlined previously with no allowance being made for spreading inaccuracies.

A satisfactory method of predetermining the proper quantity of bitumen for multiple surface treatments has not been developed, at least not to the writer's knowledge. Experience indicates approximate limits, but good multiple surface treatments have been produced with rather wide variations in bitumen quantity for the same sizes and quantities of aggregates. Limited studies made in our laboratories and comparison with experience indicate that the proper bitumen content for double surface treatments is about 130 to 140 percent of that computed for the first course stone. The quantity for triple surface treatments is about 140 to

(Continued on page 238)



● ROLLING should be started early and should be adequate. Either pneumatic or flat wheel rollers, both of which are shown herewith, may be used satisfactorily.

PLYWOOD PANELS

for Trench Shoring

ONE OF Long Island's larger contracting firms has effectively replaced older and hazardous methods of shoring up the dirt walls of sewer trenches by using fir plywood panels. These have not only proven safer but have also reduced digging crews from ten to eight men and reduced material costs because of the re-usable advantages of the panels.

The Zara Contracting Company, Hicksville, Long Island, New York, replaced the older method of using 2x10-inch shoring stock every four feet by switching to 4x8-foot panels of $\frac{5}{8}$ -inch exterior type fir plywood. These panels are placed upright on both sides of sewer trenches.

The system works like this: Immediately following the trenching machine, crews place the plywood panels along each freshly cut wall spaced two feet clear and so that the panels face exactly opposite on either side of the trench. Then 8-foot vertical 3x8 uprights are nailed to the center of each panel. To these uprights, horizontal walers, consisting of about 5-foot lengths of 3x8's, are forced between the vertical uprights so they run across the trench about two feet down from the top of the plywood panels. Finally, three-foot 2x8 horizontal walers are forced into the same position about three feet up from the bottom of



● PLYWOOD panels are placed 2 ft. clear along the trench wall, as shown above, immediately following trencher.

the panels. All walers are nailed to the vertical uprights. As each section of sewer pipe is installed, the lower waler is removed to facilitate pipe installation.

This plywood method of sheeting can be installed faster and removed quicker while still providing the necessary strength required effectively to brace tons of earth. Joe

Gibbons, estimator for the Zara firm, says "By using the plywood sheeting our gangs can work faster and cover a larger area than when the 2x10's were used. Actually, the plywood sheeting allows us to cut two men from a crew of ten men and a foreman on a trenching machine crew."

The firm has saved money on material costs as well as labor. The plywood sheeting eliminates many expensive braces and can be used over and over. Costly cave-in accidents have been practically eliminated. "Plywood sheeting is safer," Mr. Gibbons says. "It is particularly valuable in sandy areas. Even though there is a space between the sheets, the sheeting tends to hold that area by holding back the walls firmly on either side."

Tony Orsino, superintendent of Zara construction crews, estimates that in a recent job done in Baldwin, L.I., N.Y., up to 200 feet of ditch was gained in one eight-hour shift by using the fir plywood sheeting. This was because soil in the particular area was mostly sand and pea gravel.

In one week one of his crews set a "sort of record" by digging 612 feet of sewer trench with one machine, while one gang placed the plywood sheeting—all in the space of eight hours.



● UPRIGHTS of 3 by 8's, 5 ft. long, are nailed to center of panel and horizontal walers placed near top and bottom.



● VIEW of bottom ends of sheeting. This system has been lower in cost than methods previously used and also safer.

AUTOMATIC TREATMENT PLANT and AMPLE STORAGE

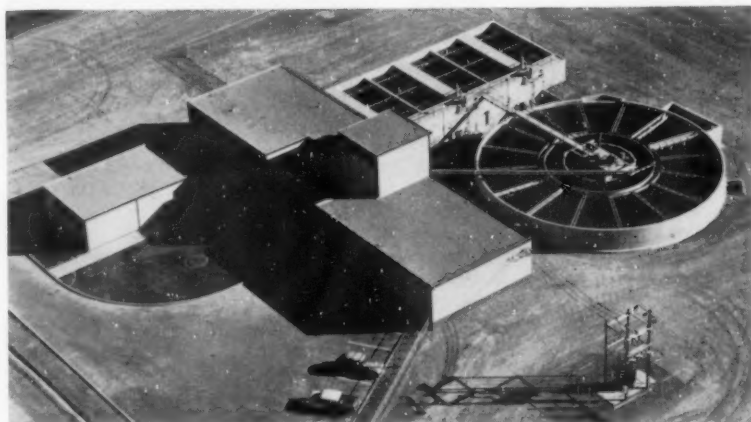
JOSEPH F. GOLDEN

Golden, Bryant & Jehle,
Architects and Engineers,
El Centro, California

THE IMPERIAL VALLEY OF California is an agricultural wonderland, known the world over for its fabulous crops and its 115° summer temperatures. El Centro, a county seat with a population of almost 18,000, is about ten miles from the Mexican border. El Centrans live and work in air conditioned buildings, drive air conditioned cars, and consume almost 600 gallons of water per day, per capita, during the hot summer months, without any assist from industry. This is probably the world's record for purely domestic water consumption.

The source of all water for irrigation and for domestic use for this entire valley is the Colorado River. Water is diverted from the river at Imperial Dam, about twenty miles upstream from Yuma, Arizona, and flows to the valley through 100 miles of the All-American Canal, one of the biggest ditches in the world. From the terminus of this canal at the southern edge of Imperial Valley, which is also the Mexican boundary, the water is carried northerly through smaller canals, approximately one-half mile apart, to irrigate the farmland and supply the five cities of the valley. These canals are the lifeblood of this land, without which it would again revert to desert. Obviously, water supply is a very important matter to the people of El Centro.

El Centro's first water treatment plant was a slow sand filter, constructed in 1924; in 1946 rapid sand filters were constructed to bring the plant capacity up to a rated 6½ mgd. By 1951, the plant was having difficulty in meeting the demand, even while operating at 25 percent over its rated capacity. Other water

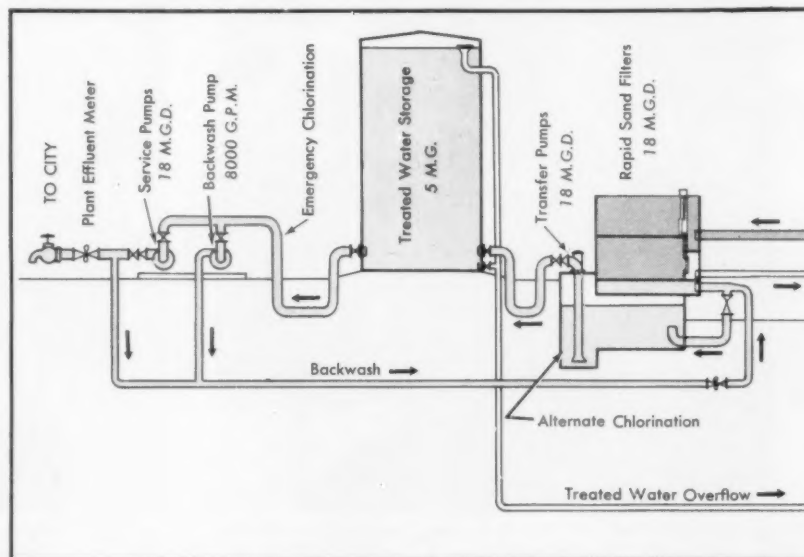


● TREATMENT plant for El Centro, showing clarifier, filters in the rear and pump and control building. Layout provides space for future necessary plant enlargement.

problems also began to beset the city.

Among these were the long, tenuous connection to the source of the water supply and the ever-present danger of a canal break which could cut the city's lifeline. The Imperial Irrigation District, a publicly-owned agency which operates the canal system throughout Imperial

Valley and delivers water to the cities, requires that each city provide itself with a minimum of seven days normal supply of raw water storage. For this reason, El Centro had gradually accumulated approximately 40 million gallons of storage in earthen basins covering about 50 acres within the city. After World War II, new subdivisions began to



engulf the old plant and basins, and the seepage from the unlined basins caused the surrounding water table to rise. Alkali patches appeared in adjacent gardens, the trees died, and pavements failed. Adjoining land owners instituted damage suits against the city. Another critical

south of the existing city limits, and that a new plant be constructed, with initial capacity to supply a city of 25,000, readily expandable, and having a minimum of ten days supply of raw water. The cost of such a project was estimated at approximately \$2 million.

and other non-domestic uses. The canal water was fairly low in turbidity, running as low as 10 ppm, and occasionally as high as 50 ppm. At times, it carried zoogeal slime which could not be removed by ordinary detention and settling. This slime, if not removed, would pene-

Solve El Centro Water Problems

point in the city's supply system was the old pump station, with the pumps located in a pit about 15 feet below the normal ground surface, where a break in the plant piping would flood the pump pit and drown the motors and electrical gear.

Faced with its dilemma, the city, in 1952, and again in 1953, procured two independent engineering reports. The two reports were in general agreement, and the gist of their advice was as follows:

1. The existing plant was incapable of economical enlargement.
2. The old plant site was not large enough for a new plant. The required seven-day supply, amounting to 70 million gallons of raw water storage, was not considered a desirable facility to be located in the heart of a residential area.
3. It appeared practically impossible to construct a new plant on the existing site while maintaining the old plant in operation during the construction.

The Engineers recommended that a new site be acquired, somewhere

Upon receipt of this shocking news, the City Council appointed a Citizens Committee to assist the City Manager in studying the problem. This committee, after many meetings, decided to accept the advice of the Engineers; however, they voted to limit the cost to a maximum of \$1,300,000. On April 13, 1954, the city voted overwhelmingly for the issuance of \$1,300,000 of General Obligation Bonds to finance a new water plant. A new 80-acre plant site was acquired, about one mile south of the city limits in the direction of expected growth, and Engineers were employed to prepare the plans and specifications.

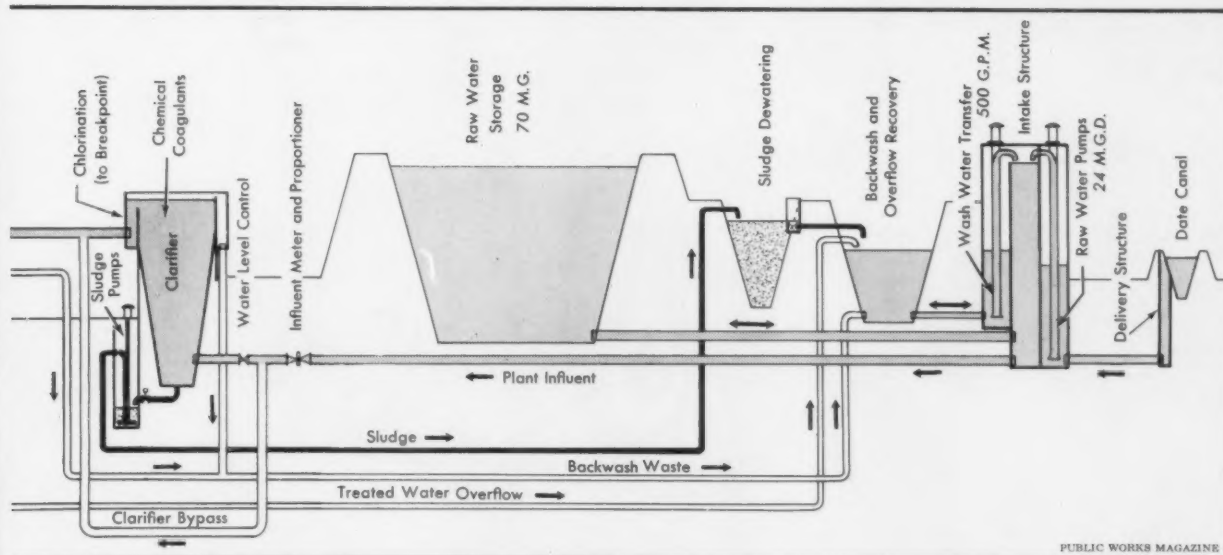
Special Problems

Some rather unusual problems were encountered during the detailed design of the project. Previous economic studies had determined that municipal water softening would not be economical because of the extremely heavy use per capita, most of which went for lawn sprinkling, air conditioning,

trate into the filter sand and cause a great deal of trouble. The City of Calexico, using the same source of water, had good results over a number of years using a solids contact type clarifier, and on the basis of this experience, this type of unit was selected for clarification. The other treatment required included filtration and disinfection. This much of the design was fairly well established. The details of the tremendous amount of raw water storage, and the fact that there was no available drainage channel in which to waste any water from the site, presented interesting problems.

The site acquired for the new plant consisted of about 80 acres of level farmland, bounded on the east by the Date Canal, and on the west by the Dahlia Canal. These canals are the sole source of supply for the city, and both terminate at the south city limits. The operation of these canals required that they be taken out of service for three days each month in order to kill the heavy growth of moss, and also for general maintenance. Since both of the canals would not be out of service simultaneously, a deliv-

● **PROCESS** diagram illustrates passage of water through the plant, with various treatment units, and bypass, overflow, sludge and backwash and overflow recovery.



ery gate was provided from both canals, thus assuring the city of a continuous source of supply so that the basins could be maintained practically full at all times.

Borings at the site indicated a heavy clay, locally known as adobe, with occasional thin, silty layers to a depth of five or six feet. At five feet, the soil was very moist and spongy, and ground water occurred at about seven feet. Laboratory tests indicated this material was suitable for basin embankment after compaction to 93 percent density. From these findings, it was evident that it would be impractical to excavate more than about four or five feet for the storage basins. Even at five feet, the wet, spongy

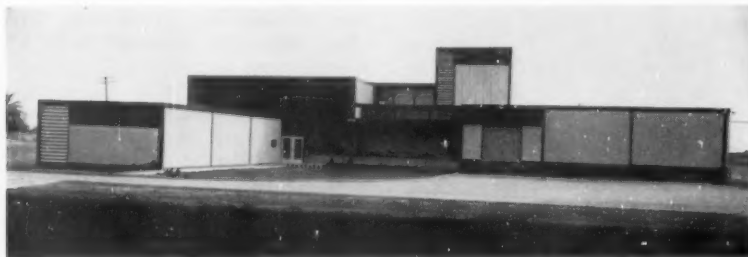
the Engineers to seek other solutions. It became evident that considerable savings in amount of earthwork and in the basin linings could be effected if the storage depth could be increased. For that reason, the water depth of the basins as finally designed was fixed at 16 feet, approximately five feet in the ground and eleven feet above ground. Pumps were provided to lift the raw water into the basins, from which it would flow through the plant by gravity. The same raw water pumps were arranged to be used for lifting the water to the plant whenever it became necessary for the city to draw on the raw water storage.

This plan decreased the required

saving in excavation and basin lining, after allowance for the \$20,000 increased cost of embankment, amounted to \$184,000, based on the actual contract unit prices. The total plant, including the storage basins, equipment, storage yards, with space for future expansion, occupies 50 acres of the site, leaving 30 acres which the city has leased out for agricultural uses.

Raw water is stored in two identical basins, each 512 ft. x 652 ft., top inside dimensions, with a 16-foot water depth and 2-foot freeboard. Embankments are of native material compacted to 93 percent, with 14-foot top width, 2:1 inside slopes and 1½:1 outside slopes. Sides and bottoms are lined with three inches of asphaltic concrete. Each basin is provided with an access ramp leading to the bottom, and the bottoms are sloped to a small drain sump in the low corner. Whenever the basins require cleaning, water will be pumped from the adjoining basin by means of a high pressure, portable, gasoline-driven pump. The empty basin will be hosed down, and the settled material sluiced toward the sump, where it will be picked up by the suction hose from a second gasoline-driven portable pump connected to a discharge header, which carries the washed-down materials to the sludge decanting basin.

Raw water is delivered from either of two canals through underground pipelines to a multi-chambered concrete structure. This structure contains six separate cells, and eleven sluice gates varying in size from 24 ins. to 42 ins. square. The raw water intake



● **BUILDING** at treatment plant. Chemical warehouse is at dock height on right; the booster pump room is the wing at left. Two-story section contains transfer pumps.

bottom would hardly support earth-moving equipment.

The maximum elevation of the water delivery from either of the canals was about one foot above natural ground at the site, which would allow a total depth of basin of only about six feet, assuming gravity flow from the canal. The necessary 70 million gallons, amounting to 214 acre feet, would, on this basis, occupy 40 acres, and would require 350,000 cubic yards of excavation. The excess excavation over the embankment would fill the remaining 40 acres of the site to a depth of more than seven feet.

Basin Design

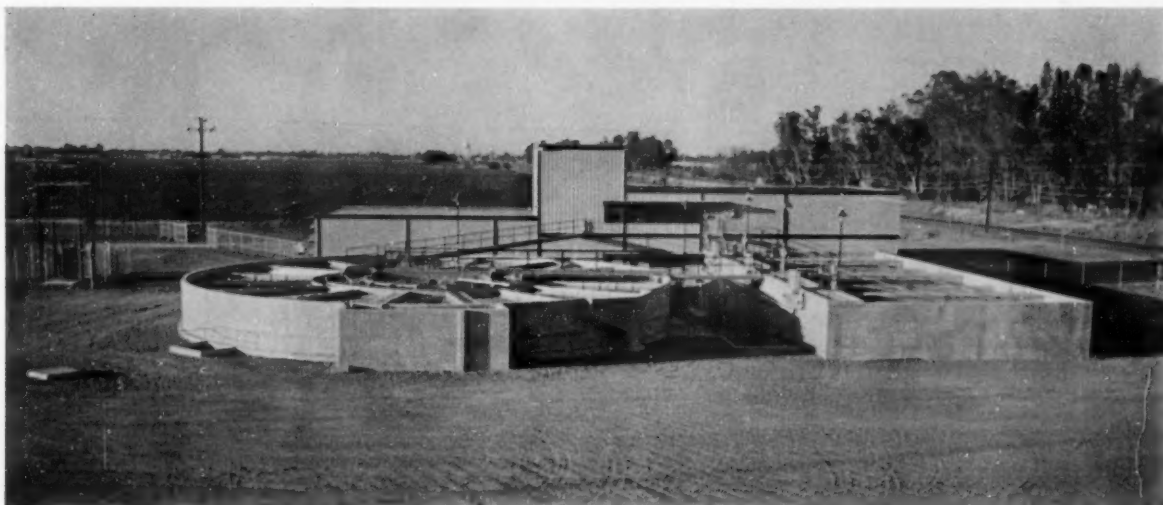
It was considered extremely important to provide a lining for the basins as protection against wave erosion and weed growth, and to permit periodic wash-down. It was expected that there would be a small amount of solids deposited in the basins as a result of the relatively long detention periods during the winter when water consumption is low. Gravity basins would require 220,000 square yards of lining for the bottoms and slopes.

The heavy excavation and the large areas of lining required caused

excavation from 350,000 cubic yards to about 110,000 cubic yards, and the higher basin embankments utilized all of the excavated material. The smaller, deeper basins also decreased the amount of lining required from 220,000 sq. yds. to about 89,000 sq. yds., and cut the total area of the basins from 40 acres to 18.2 acres. The approximate net



● **MAIN PUMP** room: Clearwell pumps left foreground, emergency generator and main power panel rear. Chief Operator Rudd in center. Compressors under stairs.



● PLANT capacity is 18 mgd. This view shows Accelerator in foreground, with the filters at the right and head works in rear.

sump contains four vertical propeller pumps ranging in size from 12 ins. to 18 ins., ranging in capacity from 2000 to 5900 gpm each. One of the pumps is driven through a variable speed magnetic drive, and the pumps are controlled in a stepless program from 2700 to 16,700 gpm, to maintain the elevation in the raw water intake sump within about six inches. The purpose of this arrangement is to maintain the sump always a sufficient distance below the canal delivery elevation, so that the Irrigation District can measure the water delivered to the City through their standard delivery gates. The stepless program eliminated the need for a large pump sump.

The eleven sluice gates permit the water to be diverted through this structure in almost every conceivable way. Normally, the water is pumped up into one basin, from which it circulates through an interconnecting pipe into the second basin, and then flows by gravity to the plant. However, it is possible to pump directly to the plant, bypassing the basins completely, or to pump one basin down into the other basin, or to pump partly to the basins and partly to the plant, as desired. In addition, whenever the canal water is not available, the basins can be run through the plant by gravity until the elevation drops to a point where it is necessary to pump, and then the basins can be pumped into the plant.

From the raw water basins, the water normally flows by gravity into the clarifier. A bypass is provided so that the clarifier can be taken out of service, if necessary. Water level in the clarifier is con-

trolled by a pneumatically-operated, 36-in. butterfly valve, through a pilot float controller. This device maintains the clarifier level at a constant elevation, regardless of the height of the basins. The clarifier is 86 ft. in diameter with an Infilco Accelerator mechanism, and has a capacity of 16½ mgd at a 3 gpm per square foot overflow rate. Water flowing into the clarifier is measured by a Sparling propeller meter at the inlet. This indicates the total plant input on a recording meter in the control room. This meter also automatically proportions the chemical feed to the clarifier and the pre-chlorination ahead of the filters. The precipitated solids and the coagulants introduced into the clarifier are removed through automatically controlled diaphragm blow-off valves, which discharge the sludge into a sump adjacent to the clarifier. Two 300-gpm sludge pumps are provided to pump the sludge to twin sludge basins located adjacent to the main storage basins. In these basins, the sludge is dewatered by means of a skimming structure located between the twin basins, and the skimmed-off water flows into the adjoining wash-water sump, where it is pumped back up into the raw water basins. Periodically, alternate sludge basins will be pumped down, and allowed to dry out, and the remaining dry material can be excavated with a skip loader and hauled off by truck.

Filter Details

The clarified water flows into the filters through a concrete flume across the end of the filter structure. Three double-bay, rectangular, rapid sand filters are provided, each

filter bay being 13 ft. x 36 ft. The underdrain system consists of 4-in. Transite pipe laterals, at 11⅝-in. centers, located transversely across the narrow dimension at each filter, and feeding into a central concrete gullet. The pipe laterals are perforated with ½-in. holes at approximately 3¾-in. centers on the bottom, and are supported on small concrete saddles a few inches above the filter floor. The underdrain pipes are spaced apart with precast concrete Wagner blocks and 14 ins. of graded gravel, from 1½-in. to ⅝-in., in uniform layers over the pipe underdrains. Over this gravel, there is four inches of coarse sand with an effective size of 1 mm. minimum, and a uniformity coefficient of 2.0, maximum; and 20½ ins. of fine sand with an effective size of 0.55 to 0.60 mm., with an uniformity coefficient of 1.7, maximum. Each filter bay contains six wash water troughs and three rotating surface wash arms. Wash water troughs are of prestressed fiberglass, 17 ins. top width and 18 ins. total depth, with a cylindrical bottom. So far as is known, this is the first use of fiberglass for wash water troughs. Filter influent and waste channels are concrete box sections, with a 24-in. hydraulic influent sluice gate and a 30-in. square hydraulically-operated waste gate. The bay separation valves and the backwash valves for each pair of filters are 16-in. hydraulically-operated butterfly valves. The filter rate controllers are pneumatically-operated butterfly valves, controlled by air pressure transmitted by a differential converter. The rate of flow controllers are also utilized as filter effluent valves by means of an

intercepting 3-way air valve in the control tables. Control tables are welded anodized aluminum. Backwash water is supplied by an 8000 gpm centrifugal pump. Wash water rates are measured by an orifice plate, and indicated on a large dial visible from the operating tables. The filter controllers are designed for a maximum capacity of 6 mgd each, and all filter piping hydraulics are based on this flow. Backwash water is discharged from the filters to the wash water basin, from which it is pumped back into the raw water basins for re-use.

The area under the filters is utilized for a small clearwell, with a transfer pump sump at one end. The floor of the clearwell is constructed of half-inch prefabricated asphalt panels. The transfer pump sump at the end of the clearwell contains three vertical propeller pumps having a total capacity of 18 mgd. These

Space is provided for a future fifth pump. Two of the pumps, rated at 6 mgd each, are dual drive, and powered with gasoline engines for standby use. Water is pumped to a 250,000-gallon elevated tank in the city through approximately 1½ miles of 30 and 24-in. transmission pipelines. All of the service pumps connect to a common suction header and discharge into the transmission pipeline. A propeller type meter is provided in the discharge header to measure the total plant output, and to control post-chlorination, if so desired.

Each service pump is equipped with an automatic check valve, consisting of a 12-in. pneumatically-operated butterfly valve, controlled through a pressure-operated pilot. These valves are adjusted to open slowly when a pump starts, and to close in advance of a pump shutdown, utilizing time-delay relays

storage warehouse located at truck bed height.

Charging hoppers are recessed in a pit in the warehouse floor, and individual vertical screw conveyors carry the dumped chemicals up to storage bins each having a one-day supply of chemicals, which are located over each feeder. The bins are equipped with high and low limit switches, which cut off the conveyors when full, and cause an alarm in the control panel when the bin is nearly empty.

The base chemical feed rate is manually set at each feeder, after which the feed is automatically proportioned to the flow into the clarifier, as measured by the plant influent meter. Chemicals are transported in solution to the primary mixing chamber of the clarifier. Lime is carried in a stainless steel trough; the ferric sulfate is transported in Uscolite pipe. Pipe and troughs are supported on a walkway from the clarifier to the chemical feeder room. This enables the operator to keep the trough clean.

Chlorinators are located in a separate space adjacent to the chemical warehouse, and are also at truck bed height. Chlorine is delivered in ton cylinders, and is rolled off the delivery trucks onto the dock floor. At this point, the cylinders are picked up on a chain hoist and carried on an overhead track into the chlorine room. A 4000-lb. capacity, dial type platform scale holds two cylinders, with space alongside for a spare cylinder. The scale dial is equipped with an adjustable magnetic switch, which is set to sound an alarm on the control panel when it is necessary to switch cylinders. The chlorine room is cooled by an evaporative cooler, and is provided with thermostatically controlled electric heat. A two-speed exhaust fan picks up air near the floor and discharges through the roof. This fan is controllable from outside the chlorine room.

Chlorination equipment consists of two identical automatic proportioning solution feed, visible vacuum-type chlorinators, having a capacity of 400 pounds per day, each. A multi-pole rotary switch permits each chlorinator to be controlled by either the plant influent or effluent propeller meter. In addition, a two-in, three-out, valve manifold permits selection of either or both chlorinators for any of three alternate points of chlorine application.

Normally, chlorine is applied to break-point, just ahead of the filters. Other points of application are located in the clearwell transfer



● GENERAL view of plant from the air shows the clarifier, filters and control building at right rear, storage tanks in center and raw water basin at the left.

pumps transfer the water from the clearwell to the treated water storage reservoirs, through a 30-in. concrete pipeline.

Treated water is stored in two 24-ft. high by 133.5-ft. diameter steel tanks, with a capacity of 2.5 million gallons each. The inlet and outlet to the tanks are 90° apart, in order to provide positive circulation through the tanks, and to avoid dead spots. From the treated water storage tanks, water is delivered to the city by the service pumps, which are automatically programmed to meet the demand.

Four horizontal, double-suction, centrifugal pumps are installed for high service duty, having a total capacity of approximately 18 mgd.

for this purpose. In addition to the two gasoline engine driven, dual drive pumps, a 150 kw gasoline engine driven standby generator is provided to power the raw water pumps and other necessary plant utilities during power outage.

Laboratory Control

Laboratory tests, prior to design, indicated that the most useful coagulants would be ferric sulfate, with powdered limestone as a coagulant aid. One powdered limestone feeder and two ferric sulfate feeders are provided. The limestone feeder can also handle lime, and the sulfate feeders can handle alum, if desired. Chemicals are received in sacks, and stored in a chemical

sump, and in the transmission pipeline to the city. The base chlorination rate is manually set at each chlorinator, after which the chlorine is automatically proportioned in accordance with the fluctuating flow, as determined by either plant influent or effluent meter, as selected by the plant operator.

A chlorine residual recorder measures the residual from a continuous sampling of plant effluent. The sampling cell is located in the laboratory, and the recorder is located in the Main Control Panel in the control room. Any variation in chlorine residual beyond the adjustable set limits will cause an alarm on the control panel.

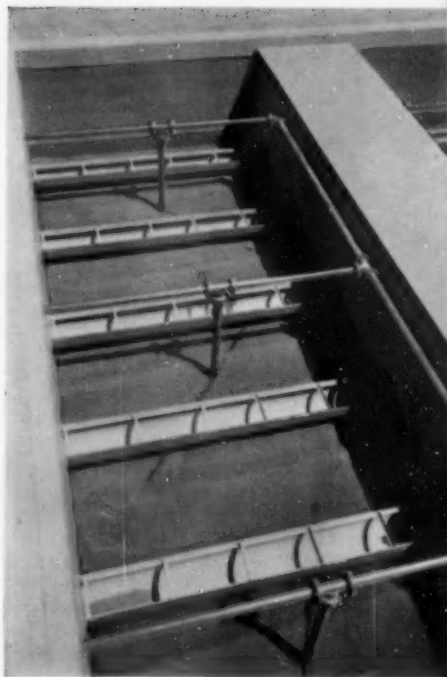
A small laboratory is located on the ground floor level, directly under the control room. The laboratory is provided with a stainless steel work sink and micarta counter, into which is built a sampling sink. A cabinet with sliding glass doors contains the necessary equipment and reagents for simple routine tests. No facilities or equipment are provided for bacteriological tests, since this work is done by a local commercial laboratory. The necessary equipment is provided for tests of turbidity, hardness, pH, calcium carbonate stability, chlorine residual, and other standard tests.

Samples from six key points throughout the plant are piped directly to the sampling sink, which permits the operators to secure all necessary samples directly in the laboratory. Samples are taken of the raw water, clarifier primary mixing chamber, filter influent, filter effluent, treated water storage tank effluent, and plant output. The plant effluent sampling line is connected to the sampling cell of the chlorine residual recorder, which is also located in the laboratory.

The control room is located on the second floor, at the level of the

filter and clarifier walkways. The room has two glass walls which overlook the pump room, the filters, the pipe gallery and the clarifier. One entire wall is occupied by the Main Control Panel, on which is indicated and recorded all of the plant functions. The control panel includes all of the various gauges, converters, regulators, and other control equipment which is normally scattered throughout a plant. The filter gauges which are usually mounted on the operating tables are omitted in this plant, and instead, a recording loss of head and rate of flow gauge for each filter is located in the Main Control Panel. The panel contains the following indicating and recording instruments: Plant influent and effluent (Sparling Striptographs); raw water basin storage level; treated water storage tank level; clearwell level; chlorine residual (sampling cell located in laboratory); plant water pressure; remote distribution system pressure (telemetered from elevated tank); filter rate of flow and loss of head; master filter rate controller; and standby engine exerciser and test recorder.

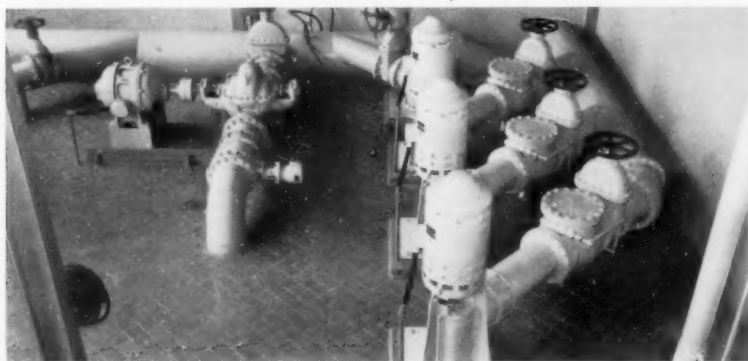
Also included in the panel are the running and demand signal lights for raw water pumps, clarifier, sludge pumps, clearwell transfer pumps, and service pumps. It is thereby possible to see at a glance which pumps are running, and whether they are under manual or automatic control. A comprehensive system of alarm signals, each with a silencer, is included in the alarm section of the panel. Any abnormal condition is indicated on the panel, sounding an alarm, which notifies the operator exactly which point is malfunctioning. Alarm signals are provided for the following: Plant water pressure (high or low); distribution system water pressure (high or low); control air pressure



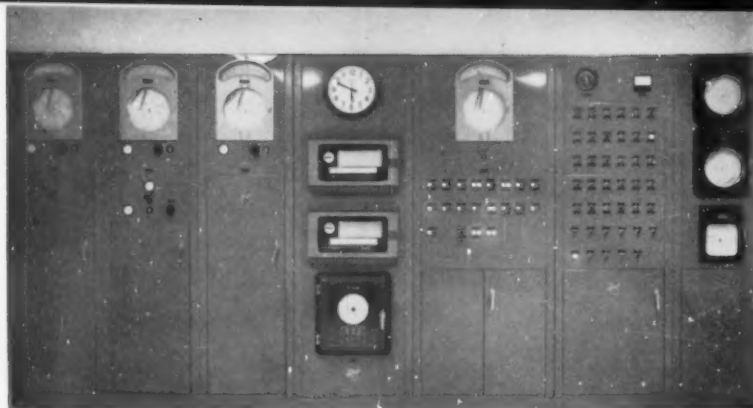
● CLOSE-UP of one filter bay, showing the fiberglass wash water troughs.

(low); chlorine cylinder (low); gasoline storage (low) (Magnetrol in underground tank); clarifier slurry sump (high level); elevated tank (overflow); chlorine residual (abnormal); chemical storage hoppers (low); filters (high head loss); clarifier or filter (overflow); clearwell (overflow); filtered water storage tanks (overflow); filtered water storage tanks (low water); raw water basins (high or low water); gasoline engine test run failure; power failure; and plant pilot failure.

Filter backwashing is done manually whenever the control panel signals the preset head loss. Except for backwashing and maintaining chemicals in the storage hoppers, the plant will operate unattended, and is fully automatic in every respect. The control system is partly pneumatic and partly electric, and is designed to be fail-safe. Whenever the plant pilot circuit is interrupted as a result of high or low water, or any other alarm condition, the plant will shut down until the situation is remedied. The water levels in each tank, sump or basin are measured by bubblers which actuate pneumatic indicating instruments and also control the various pumping programs. Filter rate-of-flow controllers also operate on the controlled air pressure principle. A float-operated transmitter which is



● MAIN PUMP room. This view shows the clearwell transfer pumps on the right and wash water pump at left. Chlorine application point in main suction at rear.



● **PUMP control panel.** The three left sections have loss-of-head gauges and master rate controller. Other sections provide for complete control of entire plant.

located on the elevated water tank at the opposite end of the city from the plant telemeters the water level to the plant via leased telephone lines. This signal actuates a program controller, which operates the four booster pumps on a seven-step, pump-up program to supply the city demand. On city demand, the resulting water level drop in the filtered water tanks allows the clearwell transfer pumps to operate on a pump-down program of the clearwell.

Water level drop in the clearwell restores the plant pilot high water cut-off, which allows the filter controllers and the clarifier influent valve to open. The filter rate-of-flow controllers will modulate their rate in accordance with the level of the filtered water storage tanks. Under this arrangement, the filters will operate at the minimum rate-of-flow necessary to keep the filtered water storage tanks full at all times. When the city demand is satisfied, the following cycle takes place: (a.) The water level rises in the remote elevated tank, shutting down the service pumps in sequence. (b.) The water level rises in the filtered water tanks, causing the filter rate-of-flow controllers gradually to reduce their flow down to about 20 percent of capacity. (c.) When the filtered water tanks are completely full, the high water cut-off will shut down the clearwell transfer pumps. (d.) The clearwell level continues to rise from the 20 percent flow from the filters until the clearwell is full, at which point the high water cut-off will open and de-energize the plant pilot circuit, thereby causing tight shut-off of all the filter rate-of-flow controllers and the main influent valve.

At this state, the filtered water tanks, the clearwell, the filters and the clarifier are all full, and flow through the plant has ceased. Also, the de-energizing of the plant pilot has cut off the chemical feeders and the influent chlorination. Failure of the raw water supply will cause the

clarifier level to drop, and the resulting low water in the filters will operate the low-water cut-off and will shut the rate-of-flow controllers down tight. A low-limit switch operated from the influent propeller meter will open on low flow, thereby shutting off the chemical feeders and the chlorinator.

Plant Design

The filter tanks and clarifiers are concrete, and the filtered water tanks are welded steel. The clarifier and filters were supported on piling because of the poor foundation afforded by the soils at the site. The steel treated water reservoirs were constructed without special foundations; however, allowance was made for a predicted 5-in. settlement by providing O-ring slip joints at the pipe connections to the inlet and outlet of each tank. The central circular slab in the bottom of the clarifier tank was also supported directly on the earth, although the

clarifier walls were founded on piling. This circular slab was provided with an O-ring water seal around the perimeter, designed to permit a 5-in. settlement without leakage. The clearwell under the filters has a floor made of prefabricated asphalt panels, ½ in. thick. A tile under-drain system in a gravel bed is provided under the clearwell and under the clarifier, and discharges into the clarifier sludge sump.

The plant building was designed with a rigid steel frame, a steel roof deck and pumice block filler walls. The tower section which houses the chemical storage hoppers utilizes the same steel roof deck as wall panels.

The entire plant building is ventilated using two evaporative blower-type coolers with a total capacity of 26,000 cfm, designed to remove equipment heat. In addition, the laboratory and control room are completely air conditioned.

The filters were designed using the high rate experiments of Baylis and others as the basis, and will permit rates as high as 4½ gpm per square foot. The filter troughs are built entirely of ½-in. fiberglass, and utilize fiberglass angles as stiffeners. The troughs were vacuum bag molded, using a unidirectional glass material impregnated with polyester resin. This material has a tensile strength of 73,000 psi and a flexural modulus of elasticity of 4,000,000 psi. The tested deflection of the troughs when fully loaded is ap-

(Continued on page 236)

CONTRACTORS AND EQUIPMENT MANUFACTURERS

Contractors

Water Treatment Plant:
Fred J. Early Jr. Co., Inc.
Raw Water Storage Basins:
N. J. Basich Company
Water Transmission Pipelines:
Glanville Plumbing Company
Filtered Water Storage Tanks:
Chicago Bridge & Iron Company

Equipment Manufacturers

Fairbanks, Morse & Co.:
Service pumps, clearwell transfer pumps
De Laval Pump Co.:
Service pumps
Nagle Pump Co.:
Sludge pumps
Cascade Pump Co.:
Raw water pumps
The Louis Allis Co.:
Variable speed drive
DeVilbiss Co.:
Air compressor

Frazier-Wright Co.:
150 KW Generator

Wallace & Tiernan Incorporated:
Chlorination equipment, chlorine residual recorder

Inflico Inc.:
Clarifier (Accelerator), chemical feeders, hoppers and conveyors, filter rate controllers and filter gauges

S. Morgan Smith Co.:
Clarifier basin controller, automatic check valves

Nordstrom Valve Div., Rockwell Mfg. Co.:
Transmission line valves

Reinhold Engrg. & Plastics Co.:
Filter troughs

Sparling Meter Co.:
Propeller meters

Automatic Control Co.:
Telemetry and control equipment, and main control panel

Square D Co.:
Power panels

The OPERATION of WATER TREATMENT PLANTS

Revised and expanded by
CLAYTON H. BILLINGS
Associate Editor

THE TREATMENT of water for public consumption and use involves a public trust; not only is the health of the public protected through the delivery of safe water, but safety of life and property depends on the constant availability of water under pressure. This latter factor ties in with an economic reason for care in water treatment. A corrosive or incrusting water in the distribution system can result in rapid deterioration of a sizable public investment, not to mention the damage to water heaters and other appliances in the residential and commercial structures in the community.

In the interest of providing a source of basic information and a simplified approach to the study of standard references on water plant operation, this text was published first in 1938. Its widespread use attested to its value for home study and in-service training and prompted several revisions of which this is the fourth. This edition is intended to be used with "Water and Sewage Chemistry and Chemicals," which appeared in the October, 1956, issue of PUBLIC WORKS and available as a reprint.

It is not expected that these two articles will meet every need of the student; the following standard references should comprise the minimum library:

(1) *Standard Methods for the Examination of Water, Sewage, and Industrial Wastes*, American Public Health Association, 1790 Broadway, New York, N. Y.;

(2) *Manual of Water Quality and Treatment*, American Water Works Association, 2 Park Avenue, New York, N. Y.;

(3) *Manual of Water Sanitation Practice*, U. S. Public Health Service, Government Printing Office, Washington, D. C.;

(4) *Water Supply and Purification*, International Textbook Co., Scranton, Pa.;

(5) *The Water Works Manual*, PUBLIC WORKS PUBLICATIONS, 200 South Broad St., Ridgewood, N. J.

Units of Measurement

Water, in the plant and system, is measured in terms of volume, usually in gallons (gal.) and in million gallons (MG). When quantity of production or rates of flow are expressed, units of time enter and the terms become gallons per minute (gpm) and million gallons per day (MGD). For a surface stream, hydrologists choose to employ cubic feet (cu. ft.) and cubic feet per second (cfs), also known as "second-feet." A reservoir or lake volume is referred to in terms of acre-feet (ac. ft.), which is the volume of one acre one foot deep.

There are 7.48 gals. in one cubic foot; 43,560 square feet in one acre or cu. ft. in one acre-foot. The inter-relationship of these terms is easily determined as a simple multiplication and division problem. For example, to determine how quickly a draft of 1,000 gpm will deplete a water volume of 1 ac.-ft.:

$$\frac{43,560 \times 7.48}{1000} = 325.8 \text{ minutes}$$

Weight-volume relationships should also be familiar to the student of water works operation. Chemical

dosages are figured in pounds per million gallons (lbs./mg), grains per gallon (gpg) or parts per million (ppm). The last-mentioned unit is a weight-of-chemical to weight-of-water ratio. In other words one ppm would be 1 lb. of chemical per million pounds of water. The Tenth Edition of *Standard Methods for Examination of Water, Sewage and Industrial Wastes* points out that ppm is an awkward expression because water is seldom measured in terms of its weight. It is indicated that a weight-volume expression, milligrams per liter (mg/l) is to be preferred. Because of the decimal relationships between units in the metric system, one ppm and one mg/l have the same values. Throughout this text, the new trend will therefore be observed, and the expression, mg/l, will replace ppm.

In the laboratory, units of the metric system are extensively used, milliliters (ml), liters (l), and grams (gm). The Centigrade scale of temperature measurement is also applied. The student is referred to "Water and Sewage Chemistry and Chemicals" for detailed discussions of the application of these terms.

Procedures in Testing

Laboratory Equipment—Because intelligent control of the operation



Courtesy Morrison-Gottlieb

● LABORATORY at St. Charles Parish, La., permits good control of plant operation.

of a water plant is impossible without constant recourse to a laboratory, every plant should have one. It is not necessary that the laboratory be large, nor the equipment costly. What is needed depends upon the tests that are to be performed, and these, in turn, depend upon local conditions. A laboratory layout for a small plant and a list of the equipment needed to make the various tests can be obtained from your State Board of Health by addressing the State Sanitary Engineer.

In all water testing procedures, the instructions in *Standard Methods* and other reliable texts should be followed in detail. Some of the tests are presented hereafter in a simplified form, including pH, alkalinity and acidity, hardness, and residual chlorine. Procedure in bacteriological examination of water will be discussed, but the details and technique of this and the other tests must be learned through attendance at short schools or other courses of instruction that are provided in almost every state.

Taking Samples for Physical and Chemical Tests—From 2 to 4 quarts of water (2 liters or more) are required for the usual physical and chemical tests. The water should be collected in bottles of resistant borosilicate glass, if available, hard rubber, polyethylene, or other inert material. If the storage period is short and the nature of the sample is such that it is not affected by soft glass, a 2½-liter acid bottle with a "bell closure" is satisfactory. In the use of glass bottles, glass stoppers are to be preferred, but tin-wrapped cork stoppers are suitable for many samples.

Sample bottles should be cleaned thoroughly. For glass bottles, a cleaning solution containing chromic acid is recommended. This may be prepared by adding one liter of concentrated sulfuric acid, slowly, carefully, and with stirring, to 35 ml of saturated sodium dichromate solution. Rinsing with an alkaline permanganate followed by oxalic acid solution is effective, also. Detergents may be used for cleaning hard rubber or polyethylene containers. After the cleaning procedure, the bottle should be carefully rinsed in tap water and distilled water.

Care should be observed to obtain a representative sample, particularly when it contains turbidity or suspended solids. The sample bottle should be rinsed two or three times with the water to be collected.

When taking a sample from a stream or lake, place the bottle about 18 inches below the surface in order

to avoid the surface film. Then remove the stopper; fill the bottle; and replace the stopper. When taking a sample from a faucet that has been closed, or from a similar source, allow the water to run to waste for a few minutes. If the sample is taken from a pump, sufficient water should be wasted to empty all of the pump connections and to draw from the well, main or other source. Containers should be filled completely.

Tests should be made promptly after the sample has been collected. According to *Standard Methods*, examinations may be made on unpolluted water within 72 hours, on fairly pure water within 48 hours and on polluted water within 12 hours. These are maximum limits; shorter elapsed periods are desirable.

Some test results are likely to be affected by storage; pH is subject to almost immediate variation and dissolved gases may be lost. For that reason, tests for pH, dissolved oxygen, carbon dioxide and determinations for other gases should be made in the field.

Testing for Turbidity—Particles of soil carried in suspension in the water cause a muddy or turbid appearance. Such water is objectionable for general use and must be treated, though turbidity itself may not affect health.

Permissible Limits — The upper limit of turbidity that will not cause complaints from consumers is about 5 units but a turbidity of 10 is generally considered permissible.

Determining Turbidity — The Jackson candle turbidimeter is the standard turbidity test instrument. The test results are read from calibrations on a glass cylinder filled with the sample to the point that a candle burning beneath the cylinder appears just extinguished when viewed through the depth of the sample. Turbidity values may be

read directly from the cylinder between 25 and 1000 units. Below 25, the value is determined by comparison with standard suspensions calibrated with a Jackson turbidimeter before the suspensions have been diluted. Above 1000 units, the values are determined by diluting the sample with distilled water and multiplying the readings by the appropriate dilution factor. Other turbidimeters are available, but they should be checked against the standard instrument. Detailed procedures are given in *Standard Methods*.

Color in water is due to material that is in solution in the water, as from decaying organic matter in swamps, where it consists of the tannates, gallates and organic acids from leaves and bark and from plants. An apparent color is sometimes caused by colored matter in suspension, but true color is in solution.

Permissible Limits—Color is objectionable, though ordinarily harmless; to avoid complaints from consumers, water should not contain more than 10 color units.

Determination of Color—A standard 50 ml Nessler tube may be used. This is filled and compared with a series of color standards by placing the samples on a white surface and looking down on them from above.

Color solutions for comparisons may be made by dissolving potassium chloroplatinate and cobaltous chloride in distilled water, but it is simpler to purchase the standards, either in solution form, or as colored glass discs.

When there is suspended matter in the water, removal of such matter must precede the color test. Filtering produces a decolorizing action; removal of the suspended matter by centrifuging is best. For details of procedure refer to *Standard Methods*.

THE MINERAL CONSTITUENTS OF WATER

Alkalinity, hardness, acidity and salinity occur in water due to the presence of certain soluble materials. These qualities are measured by means of several tests which, in some cases, are nearly enough related to each other to cause confusion. A particular example is the broad use of the term "alkalinity", which is employed as the opposite of "acidity" in connection with pH or hydrogen ion tests; and is also used to designate the amount of certain dissolved minerals that the water contains—the bicarbonates, carbon-

ates and hydroxides of calcium, magnesium, sodium and potassium. In this article, pH refers to the intensity of alkalinity or acidity and alkalinity refers to the amount of carbonates, bicarbonates or hydroxides that are present.

The student is referred to "Water and Sewage Chemistry and Chemicals" for more information on the significance of these characteristics and procedures for their determination.

Equipment for Tests—Determination of alkalinity and acidity is sim-

ple. The minimum equipment includes a burette (50 ml capacity, with 1/10 ml graduations, and a stop cock); a burette support; a 100 ml cylinder; 6 Erlenmeyer flasks; indicators; and the acid solution for determining alkalinity. For determining acidity, very little additional equipment is needed.

If desired, electrically operated titrimeters or pH meters may be employed. The same standard solutions

Works Association, 2 Park Avenue, New York, N. Y.

Hardness

Theoretically, not only calcium and magnesium make a water hard, but iron, aluminum, zinc and manganese contribute also. Normally, however, only the calcium and magnesium concentrations are sufficiently high to warrant consideration. Through association with treatment

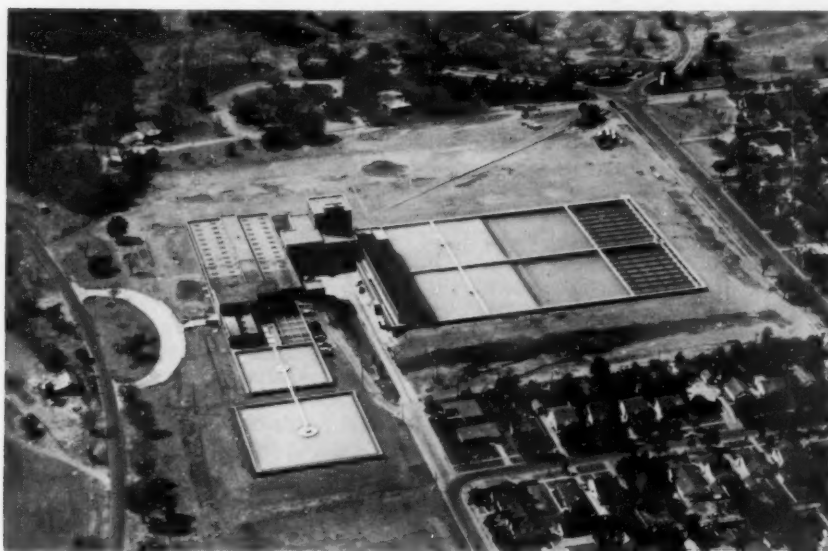
constituents used in arriving at the sum. If iron or other metals are not present, they are of course, not considered. This value is calculated from the results of a detailed chemical analysis by using the following formula:

Calcium (mg/l) \times 2.497 + magnesium (mg/l) \times 4.116. The result comes out in mg/l equivalent to calcium carbonate (CaCO_3). If iron is present, its value is multiplied by 1.792 and added to the total. If manganese is present, the factor is 1.822.

Soap Method—Often the water works department is concerned over the hardness because of its soap consuming capacity. This value may be determined by titration of sample of the water with a standard soap solution, the end point being the persistence of a lather for a full 5 minutes. When hardness is determined in this way, it is expressed, "hardness (soap)."

EDTA Method — The determination of calcium and magnesium, and consequently the hardness attributed to them, may be simplified by a colorimetric titration method which is described in *Standard Methods* as tentatively accepted, though quite widely used, especially in routine plant control. It depends on the formation of "complexes" with the calcium and magnesium present. In a "complex," the calcium and magnesium are not free to disperse in water as individual ions and the extent to which complex formation occurs can be measured. This has also been called the Versenate method. The sodium salts of an organic acid, ethylenediaminetetraacetic acid, shortened for simplicity to EDTA, form colorless complexes with calcium and magnesium, and this is used as one reagent. The other principal reagent is a dye, Chrome Black T, which also forms complexes with calcium and magnesium. The dye is normally blue in water at a pH of 8.5 to 11.5. If traces of calcium and magnesium are present the dye turns wine red. In the titration procedure, the EDTA reagent extracts the calcium and magnesium from the dye complex, and when this is completed the sample turns from red to blue.

A buffer solution is added to increase the pH of the sample, diluted with distilled water, to the proper range, and the dye is added, which turns the solution wine red. The sample is then titrated with the EDTA reagent until it turns blue and all traces of red disappear. To avoid precipitation of the calcium and magnesium before the test is completed, it is recommended that the sample titrated not require more



Courtesy Dorr-Oliver

● MODERN water treatment plant at Wichita, Kans., has capacity of 112 mgd. The increasing demands for water requires skilled operation as well as ample capacity.

are used, but the end-points are determined by meter readings rather than colorimetric indicators. The performance of pH tests by means of comparing color reactions of the sample with standard colors is simple and inexpensive, but electrically operated pH meters offer many advantages.

The colorimetric test for pH is interfered with by the presence of turbidity, color, high salinity, free chlorine and other factors. Also, color standards are subject to deterioration. For these reasons, the use of color indicators for pH determination is recommended for obtaining approximations only, and electrometric methods are considered standard for more precise work.

The carbonate, bicarbonate and hydroxyl alkalinities, pH, temperature and mineral content in a sample of water are inter-related, and nomographic charts have been devised for rapidly determining the various forms of alkalinity and carbon dioxide from temperature, pH and total numeral concentration. A set of these nomographs may be obtained from the American Water

methods and partly to compensate for abandonment of the "temporary" and "permanent" hardness classifications, a distinction is made as to whether the hardness present involves the carbonates and bicarbonates as determined by the alkalinity test. The hardness equivalent to or less than the total alkalinity composed of carbonates and bicarbonates is called "carbonate hardness." Since hardness and alkalinity are both expressed in terms of mg/l of calcium carbonate, the values may be added and subtracted. If the hardness, then, is greater than the total alkalinity, the value equal to the alkalinity is the carbonate hardness and the rest is "noncarbonate" hardness.

Determining Hardness by Calculation—Strange though it may seem, the value of hardness of a water may vary, depending on the tests by which it is determined. Theoretically, since hardness is caused by the calcium, magnesium and other metals present, it is the sum of these constituents. That value is known as the "theoretical hardness" or "hardness (Ca, Mg, Fe, etc.)," the symbols shown in the parenthesis are the

than 5 ml of EDTA reagent; if it does, precautions should be taken as adding 90 percent or more of the EDTA reagent before the buffer is added. In any case, the titration should be completed in 5 minutes after the buffer is added. Hardness determined by this method is reported as "hardness (compleximetric)" or "hardness (EDTA)."

Aluminum, cadmium, cobalt, copper, iron, lead, manganese, nickel, zinc and polyphosphate interfere with this test, but inhibitors can be

added to avoid this interference. *Standard Methods* outlines the procedures to be employed.

Because EDTA combines with calcium before it reacts with magnesium, by using a different indicator, ammonium purpurate (murexide), the calcium alone may be determined. The pH of the sample is raised to about 12 and upon the addition of the indicator, the sample turns pink. When the EDTA completes the extraction of the calcium, the solution turns purple.

BACTERIOLOGICAL EXAMINATIONS

Bacteria are very small organisms visible only by means of a microscope and measured in terms of microns. A micron is 0.001 millimeter or about 1/25,000 inch. One method of classifying bacteria is by shape. Under this method there are three general types: *Cocci*, which are round or spherical; *Bacilli*, which are rod-shaped, like a cigar; and *Spirilla*, which are spiral, like a corkscrew. Bacteria normally found in water supplies are of the *Bacilli* group, and are from 1 to 4 microns long and about 1/4 as thick.

For the water works operator or superintendent or sanitary engineer, concerned primarily with preventing waterborne disease, there are two broad classifications—pathogenic, which are disease-bearing or disease-producing; and non-pathogenic, which do not produce, cause or convey disease.

Non-pathogenic bacteria cannot be ignored entirely, because the presence of certain of these is often strongly indicative of the possibility that disease bearing bacteria also are present. For instance, typhoid bacteria are very difficult to find in water, so that the usual procedure is to test for the coliform group, which are constantly present in the human intestines and in urine and feces. If such bacilli are found it is practical proof that the water is contaminated with sewage. The coliform group, however, do not cause disease.

It is for these reasons that reports of bacterial examinations of water show the results of tests for coliforms, and if these are present the water is condemned as being potentially unsatisfactory or of unsafe sanitary quality, even though no examination has been made for pathogenic bacteria.

Bacteria multiply very rapidly so that a single bacterium, under favorable conditions, will produce

many thousand others in the course of 24 hours. Temperature is important; for these organisms, such as coliforms, which live in the body, body temperatures are most favorable, but multiplication takes place even at much lower temperature. A temperature of about 135° F kills most of these bacteria.

While low temperatures are unfavorable to bacteria, even freezing will not kill all of them, and typhoid bacteria have survived for months in ice. Therefore the use of ice from contaminated water is dangerous.

Collecting Samples—There are three important steps in examining water for bacteria: These are: (1) Collection of the sample; (2) determining the total number of bacteria; (3) determining the presence and total number of the coliform group.

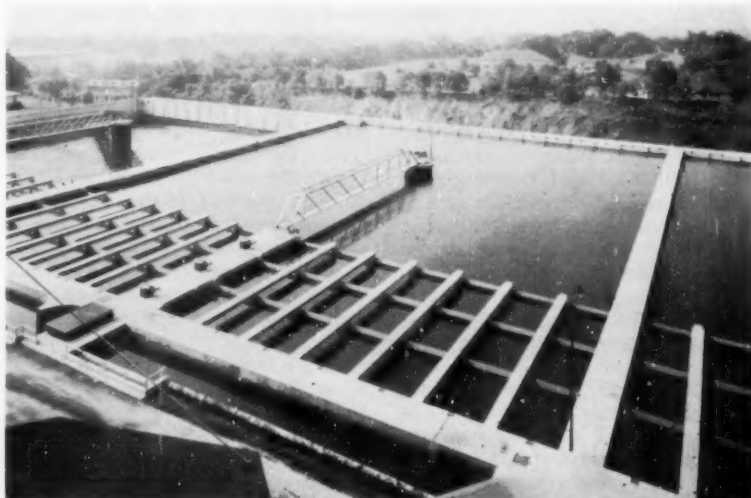
Samples must be collected in a clean, sterile bottle, usually of 4 to 8 ounces in capacity. The tops and necks of the bottles should be protected with metal foil, rubberized

cloth or heavy paper, placed before sterilization. When samples of water are likely to contain chlorine residuals, as from swimming pools or from a treated water supply, use a bottle containing a dechlorinating agent, sodium thiosulfate, added prior to sterilization of the bottle. Containers prepared in this manner may be obtained from a laboratory.

When collecting the sample, avoid taps that are infrequently used or leaking taps. Allow the water to run at least 5 minutes. Hold the sample bottle near the bottom, and remove the cap with the hand remaining on the outside of the protective covering. Care should be observed that neither the exposed part of the cap or stopper nor the lip of the bottle touch anything, because a false positive result could be obtained. Fill the container to within half an inch of the stopper or top, and replace the stopper or cap securely with the hand remaining on the outside of the protective covering.

Samples should be tested as promptly as possible after collection and during any period of storage the temperature should be between 0°C and 10°C. The time and date of collection should be recorded with other sample identifying data, because the analyst must report, with his findings, the time elapsed between collection and examination.

The number of bacteria is determined by mixing a small portion of the sample water with liquefied culture media and placing in an incubator for 24 hours, if the temperature is held at 35°C, or for 48 hours if the temperature is 20°C. Each bacterium in the water multiplies under those conditions into a colony which is visible without



● BALTIMORE'S treatment plant utilizes modern mixing and sludge removal units. Courtesy Link-Belt Co.

a microscope. Thus by counting the colonies on the culture media in the petri dish, the number of bacteria is known.

The examination for the presence of coliform bacteria is made by adding small portions of the water to tubes containing lactose broth, or lauryl tryptose broth and observing whether fermentation of the broth occurs upon incubation of the sample broth at 35°C for 24 or 48 hours. If fermentation occurs, gas forms in a small inverted tube placed in the test tube containing the mixture. The presence of gas constitutes a positive "presumptive" test. Further tests should be made to ascertain the presence of coliform organisms. The "confirmed" test involves transferring a small portion of the fermented broth to brilliant green lactose bile broth or to Endo or eosin methylene blue agar. If positive results are obtained, a further step may be taken, the "completed" test, which involves actual observation of the coliforms by means of a microscope. Most routine plant control procedures cease with the confirmed test.

Membrane Filters. The procedure described requires 3 to 5 days for completion. A shorter method has been developed which permits at-

tainment of results in less than 24 hours. This is known as the membrane filter procedure and has been accepted in *Standard Methods* as a tentative method by which the positive results are considered roughly equivalent in sanitary significance to those obtainable in the standard test. The sample is filtered through a sterile cellulose membrane using special apparatus. The membrane is incubated in contact with an absorbent pad containing E.H.C. Endo or B.G.F. medium. Dark colonies having a yellowish, metallic appearing luster are counted as coliform organisms.

Only brief outlines of the procedures required are presented; the techniques must be learned by actual performance at short schools or courses of instruction.

Some of the more recent applications of the membrane filter procedure have indicated that the presence of coliforms may be determined in eight hours. Because of the rapidity of the test, it has been found advantageous in instances where the time element is critical; for example, in determining the effectiveness of chlorination of new mains, where the mains are held out of service pending the outcome of results.



Courtesy Chain Belt Co.

● **SCREEN** of mechanically cleaned type is desirable for larger plants.

WATER PURIFICATION

Intakes and Screens. Intake structures are needed to draw water from lakes or streams; merely laying the pipe out into the water is not satisfactory, for the pipe may sink into the mud, or may draw sand or debris along with the water. The pipe must be protected from movement, and the intake should be located somewhere near mid-depth of the water. This location avoids floating material, wave action, and surface ice, as well as stagnant water near the bottom. Intakes vary greatly, according to the size of the water supply, depth and bottom character of the lake, direction and intensity of winds and currents, and quality of the water. Their design is an engineering job.

A screen should be placed over the inlet structure. Generally a screen having a mesh of about one inch may be used, and the screen openings should aggregate about twice the area of the pipe or intake opening. A low entrance velocity draws less floating material into the inlet. The screens should be removable, or other provision made for occasional cleaning. A rake can be

used to remove any material caught on the screen. Occasional scrubbing and inspection are desirable.

Ice Troubles.—In northern areas, anchor or frazil ice may cause troubles. Frazil ice consists of small crystals which are carried below the surface by even slight currents and which deposit on intakes or screens. Anchor ice forms directly on objects in shallow water. Metal surfaces are especially subject to ice clogging of this sort.

Occasional reversing of the flow of water from the pipe into the lake sometimes helps in removing ice accumulations. Large openings and low velocity through the intake reduce ice trouble. A boom of floating timber to create an area of still water around the intake is often helpful, especially in smaller reservoirs. Such a boom may also be advantageous in keeping out leaves, twigs and other floating material.

Small oil or kerosene burning units to generate steam quickly are effective in removing or in relieving frazil or anchor ice clogging. A very small rise in temperature on the exposed surfaces is enough.

Self-Cleaning Screens.—There are several types of screens that can be installed at or near intakes that clean themselves automatically. These consist of an endless or jointed belt of screens which are moved slowly upwards by a small motor. The solids caught on the screen are removed at the top by a small jet of water and dropped into a trough.

This type of screen can be installed at an intake, if electric power is available, or at the treatment plant or reservoir. A $\frac{1}{4}$ or $\frac{3}{8}$ -inch mesh screen is commonly used, this being possible because regular cleaning prevents clogging. Occasionally a finer screen is used and can be employed to remove algae and slime.

Fixed screens should be scrubbed or squeezed as necessary to keep them clean; debris collected in them should be removed. If possible to do so, the flow of water through them should be reversed or the water shut off and the wash water wasted. Revolving screens may be hosed down or scrubbed from time to time; lubrication of mechanical screens should follow the directions of the manufacturer.

COAGULATION AND SEDIMENTATION

Sedimentation consists in holding the water in, or passing it very slowly through reservoirs, tanks, or basins. The particles of sand or clay that cause turbidity are about 2.65 times as heavy as an equal volume of water. If the water is held quiescent or practically so, much of this turbidity will settle to the bottom, but currents or eddies tend to hold the smaller particles in suspension and prevent them from settling. Sedimentation basins may be any size—from those that hold the water for only 2 to 4 hours, up to large reservoirs, where the water is stored for weeks or months.

In most sections of the country sedimentation alone will not remove the turbidity. Chemicals are added—usually aluminum sulfate (commonly but erroneously called alum) or ferrous or ferric sulfate and lime. These chemicals produce an insoluble flocculent precipitate, called "floc," which settles quite rapidly, carrying with it the very fine particles of clay, and producing a clear water. After such treatment, called coagulation, the water must be filtered to remove the small particles of floc which do not wholly settle out.

Coagulation

Removal of turbidity, color and other suspended materials, colloidal in nature so finely divided that they are not removable by filtration is the object of coagulation. Many of these constituents carry negative charges and are therefore readily attached to the positive trivalent ions of aluminum and iron, generally employed in coagulation. Other materials are removed through mechanical entanglement with the floc.

The theoretical combination of the coagulants with natural and added alkalinity in the water is discussed completely in "Water and Sewage Chemistry and Chemicals." These reactions may be assumed to occur to provide a basis for calculating dosages of lime and soda ash. However, the floc formed and the end products of the reactions are known to be more complex than the simple hydroxides of aluminum and iron. The dosages of coagulants required for optimum floc formation vary widely with waters of different characteristics. The performance of the jar test, as discussed in another section, is the best method available for predetermining proper dosages.

Floc formation and coagulation

are influenced by the chemical impurities present (both anions and cations), pH, degree of mixing and flocculation, temperature, and the presence of suspended matter which can act as nuclei.

The pH range in which a given coagulant functions best and the concentration of other ions present are interrelated to some extent. For example the type of water that is most difficult to coagulate is one high in color but low in turbidity and mineral concentration. The pH range in which coagulation in this case occurs is very narrow. In the use of alum, the effective pH range may be broadened with an increase in the amount of sulfate present. Usually, however, the optimum range for coagulation of soft, colored waters with alum is around pH 5.0, and even lower with iron salts. The range for alum may extend to pH 7.5 depending on mineral concentrations, and iron salts will coagulate at a pH above 9.0.

Mixing and flocculation periods must permit time for the reactions to take place, and in the flocculation stage provide opportunity for gentle motion to permit the growth of the floc. Generally, the higher the mineral content or the higher the coagulant dosage, the less time required for mixing and flocculation. Reaction times, of course, vary inversely with temperature, and usually more coagulant should be added when lower temperatures are reached.

If precipitated calcium carbonate is present or activated carbon, floc formation is aided by the presence of "nuclei" as starting points for the floc build-up.

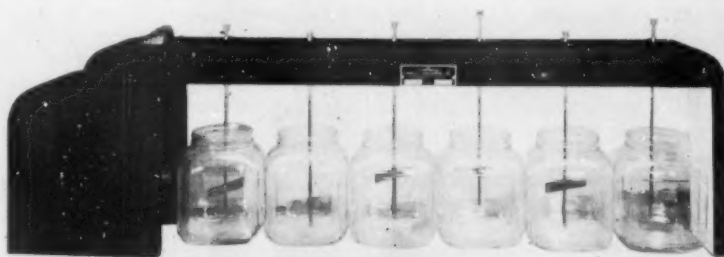
Aluminum Sulfate, or filter alum, is usually assigned the formula $Al_2(SO_4)_3 \cdot 18 H_2O$, but its composition with respect to the water of crystallization ($18 H_2O$) is somewhat in-

definite. It may be obtained in lump and in granular form packed in 100-lb. or larger paper bags and in car-load bulk lots if desired. It offers no great storage problems except that it will pick up water of crystallization from the atmosphere in humid climates.

Liquid alum is a 49 percent solution of dry alum (17 percent Al_2O_3), so that on a dry basis, it is 48.8 percent $Al_2(SO_4)_3 \cdot 14 H_2O$. Liquid alum plants are located in the paper-making areas, since the paper industry is a big consumer, and large water plants in these areas are in the best position to utilize this product. It is shipped in tank cars and trucks and offers convenience in handling and application. At the South District Filtration Plant in Chicago, the liquid alum is stored in concrete tanks lined with lead and the piping system for conveying it is of stainless steel. Rotameters are used to measure the rate of feed through a constant-level tank. Uniform, easily adjusted feeding and low labor costs as compared with the handling of the solid material provide the principal advantages.

Ferrous sulfate, $FeSO_4 \cdot 7 H_2O$, is shipped in bulk, bags or barrels. It picks up water in storage; for that reason, a product with slightly less water of crystallization is preferred. Ferrous sulfate provides a bivalent iron ion (Fe^{++}) when added to water, which should be oxidized to the trivalent form (Fe^{+++}) through chlorination or aeration, to avoid excessive solubility. Chlorinated copperas is ferrous sulfate converted to the ferric (Fe^{+++}) form through the addition of chlorine during the feeding process.

Ferric sulfate, $Fe_2(SO_4)_3$, is widely used in the granular form, in which it is known by such trade names as Ferrifloc. It is a free-flowing chemical which may be fed dry. Shipments are made in bulk, barrels and bags. The dry form has a tendency to pick up moisture and should be in tight packages if stored for prolonged periods.



Courtesy Omega Machine Co.

● JAR TEST, using equipment like this, is a help in determining chemical dosages.

Ferric chloride is available in the crystal form ($\text{FeCl}_3 \cdot 6 \text{H}_2\text{O}$) in wooden barrels; as anhydrous FeCl_3 in steel drums; or as a liquid in tank cars, glass carboys or drums. It is corrosive and should be handled and stored in contact with inert materials, such as rubber linings, glass or crockery.

Sodium aluminate, NaAlO_2 , is highly alkaline and in commercial form contains sodium carbonate and sodium hydroxide. It is usually fed with aluminum sulfate in treating turbid and colored waters. It is available in bags in the crystalline form or in drums in the liquid form.

Activated silica is sodium silicate activated in the water plant by the addition of alum, ammonium sulfate, chlorine, or carbon dioxide. It is especially valuable in treating waters low in turbidity and dissolved mineral concentrations, serves to broaden the PH range in which coagulation occurs with alum and brings about the formation of a larger, tougher floc.

Activated carbon, clay, and bentonite when added with the coagulant provide nuclei for floc formation and find advantageous application in waters having low turbidities.

Determining Chemical Dosages

There is no formula for determining coagulant doses for best clarification. Acidity, alkalinity, the character and amount of turbidity, temperature, color and other factors influence the amount and even the type of chemical. Results obtained in another plant, even one treating water of a similar nature, can be used only as a rough guide. Laboratory tests are valuable indicators of the probable dosages that will be required and should be used frequently; but, in the final analysis, actual records of results at the plant in question are the best guide.

Procedure in Making Tests—In making tests, a measured amount of the water to be coagulated is placed in beakers or jars, and dosed with different amounts of coagulant. The water and coagulant are then stirred until the floc forms, and this is allowed to settle, duplicating as closely as possible plant operations.

There are available several excellent devices consisting of 1, 2, 4, or 6 beakers, each holding about 1 liter, with electrically driven paddles for stirring the water to form the floc. Some of them have arrangements for varying the speeds of the paddles. Equipment with 4 or 6 jars is preferable. If such equipment is not available, quart fruit jars may be used, and the stirring done by

hand, with a glass rod or an egg-beater. It is best to mark each jar or beaker to indicate exactly one liter; or 1 quart, if this unit of measure is to be used.

Preparing the Solutions. It is desirable to use the chemicals at hand in the plant. No allowance for strength or purity need be made in this case.

While the use of grains per gallon is most common in plant practice, the use of mg/l is preferable for making laboratory tests, especially since the two terms are easily converted. Add 10.0 grams of aluminum sulfate, ferric sulfate, or other coagulant to 1 liter of distilled water. One ml. of this solution, when added to 1 liter of the water to be treated is equal to a dose of 10 mg/l or 0.58 gpg.

Similarly, add 10.0 grams of soda ash or lime to 1 liter of distilled water. One ml of this solution, when added to 1 liter of water is equal to a dose of 10 mg/l.

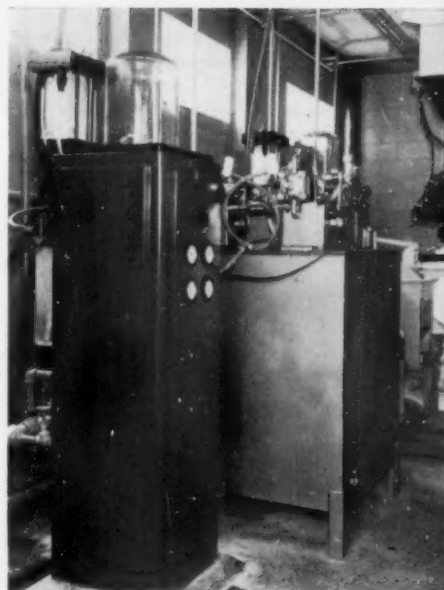
The convenience of the metric system is illustrated in this application. If one liter contains 10 grams, one ml (0.001 liter) will contain 10×0.001 or 0.01 gram, which in milligrams (0.001 gm) is 10. When this quantity is added to one liter, the concentration is 10 mg/l.

Dosages on Quart Basis—To prepare a solution for dosages for quart jars, add 8.95 grams of the chemical to 1 quart of water. One ml of this solution, added to 1 quart of water gives a dose of 10 mg/l.

Chemical Dosages for Alkaline Water. Waters that have 40 or more ppm of alkalinity will normally react to aluminum sulfate without the addition of lime or soda ash. Assuming that the water contains sufficient alkalinity, that the test is being made with six jars, and that the solution being used contains 10 grams of aluminum sulfate to 1 liter of water, the jars may be dosed as follows:

Jar Number	Dose per Jar		
	ml	mg/l	gpg
1	1	10	0.58
2	2	20	1.17
3	3	30	1.85
4	4	40	2.34
5	5	50	2.92
6	6	60	3.50

Because the test should approximate plant conditions, the agitation is commenced before the chemicals are added. Furthermore if prechlorination is practiced in the plant, the test is run using prechlorinated water. Similarly the samples are stirred for a length of time equivalent to the mixing period, used in the



Courtesy Wallace & Tiernan

● **ACTIVATED silica** can be helpful in solving some treatment problems.

plant. Following the mixing period, the floc formation is noted. If none forms, the water may be deficient in alkalinity or insufficient coagulant has been added. A large flaky floc indicates that the dose of chemical may be reduced.

Water Deficient in Alkalinity. In attempting to correct for an alkalinity deficiency, the theoretical requirement of 7.7 mg/l of alkalinity for each grain per gallon of aluminum sulfate can be kept in mind and the ratio of coagulant dose to lime varied proportionately. Actually this reaction probably does not go to completion and the requirement may be somewhat less. The concentration of alkalinity desired in the finished water must be considered, also.

Assuming that the natural alkalinity of the water to be treated is 22; that each grain per gallon of aluminum sulfate requires 8 mg/l of alkalinity (instead of the theoretical 7.7 mg/l); and that an excess or reserve of 25 mg/l is desirable, the amount of lime or soda ash that must be added for any dosage of aluminum sulfate is computed as follows:

Coagulant gpg	Reac-tion	Re-serve	To-tal	Nat-ural	Add-ed
1	8	25	33	22	11
1½	12	25	37	22	15
2	16	25	41	22	19
2½	20	25	45	22	23
3	24	25	49	22	27
3½	28	25	53	22	31

The same procedure is then followed as for the use of aluminum sulfate in alkaline waters, except that soda ash or lime solution, prepared as already described, is first added to each jar to give the dosage shown in the last column of the above table, that is, 1.1 ml for jar No. 1; 1.5 ml for jar No. 2, etc. The test can be repeated using a lower ratio of alkalinity to aluminum sulfate, until the best combination is found.

Results given by such tests are valuable as a guide in finding what dosage is best on a plant scale. The dosage shown as best by the jar test may not be the best one, in actual

plant practice, but it will usually be close to it, and with some modifications gives excellent results.

Example—From the jar test, it is found that $1\frac{1}{2}$ gpg of aluminum sulfate and 15 mg/l of added alkalinity give best results. The flow of water to be treated amounts to 720,000 gpd. How much chemical is needed?

Solution—A dosage of $1\frac{1}{2}$ gpg equals $142 \times 1\frac{1}{2} = 213$ pounds per million gallons. The flow is 0.72 mgd. Thus the aluminum sulfate required is $0.72 \times 213 = 153.4$ pounds per day. There must be added 15 mg/l of soda ash or its equivalent. The amount required is $15 \times 8\frac{1}{3} \times 0.72 = 90$ pounds per day of soda ash.

This is accomplished by reversing the flow of water through the filter, and by passing it upward through the sand at a rapid rate. This washes dirt out of the sand; the dirty water flows off into wash water troughs or gutters and is wasted.

Before filtration, the water is always conditioned by coagulation and settling, as previously described. This also is important in insuring good filtration and a clear water. Particles of the floc which do not settle collect on the surface of the sand and form a mat which aids in straining out the suspended matter and most of the bacteria.

A filter unit 18 ft. by 20 ft. will handle about 1 mgd. In very small plants, the units may be circular.

Loss of Head—The gravel bed depth (12 inches or more), plus the depth of the sand bed (usually 30 inches), plus the height of the wash water troughs above the sand (usually 24 inches), plus the freeboard above the troughs (usually some 4 feet) make up the depth of the filter. On the above basis, the depth would be 9 feet 6 inches, which would be the head available without employing negative head or suction.

FILTERS AND THEIR OPERATION

For filter purposes, quartz sand or silicates or anthracite coal, which are not affected by the water should be used. Ordinary bank sand cannot be used without screening, washing and grading to produce the correct size, and unless it is free from calcium and magnesium carbonates.

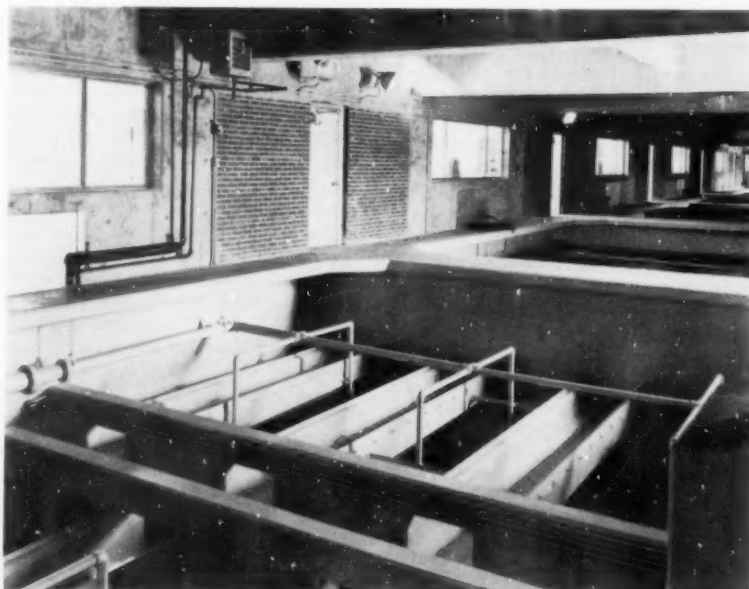
If the sand is too fine, it will offer excessive resistance to the passage of the water and will require frequent cleaning; if too coarse, it may remove too little of the material that it is desired to take out. From experience over a long period of years, the sizes of sand that give best results have been determined. Two important factors, aside from those of the composition of the sand are "effective size" and "uniformity coefficient."

Effective Size of Sand—The effective size of a sand is that size such that 10 percent of the sand grains by weight are smaller than it. This factor is simply a means of describing the fineness of a sand in terms that can be used with precision and exactness in water works practice. When described by this term, a fine sand would be one having an effective size of 0.17 or 0.18 millimeter; and a coarse sand would be one having an effective size of 0.45 or 0.50 mm.

Uniformity of Sand—The uniformity of a sand is another characteristic of importance in water purification. The uniformity coefficient is the ratio between the effective size and that size such that 60 percent of the sand is finer than it. Both uniformity and effective size are necessary to describe a sand.

A rapid sand filter consists of a bed of sand about 24 to 30 inches deep which is supported on a layer of graded gravel 12 to 18 inches

deep. The sand commonly used in a filter of this type should have an effective size of 0.35 to 0.50 mm and a uniformity coefficient of 2.0 or less; that is, the sand should be quite uniform in size. The gravel ranges from 2-inch or 3-inch pieces at the bottom to coarse sand at the top.



Courtesy Inertol Co.

● CLOSE-UP of wash water troughs in filters at Trenton, N. J. Surface washers are also shown. Concrete and steel are protected with rubber base paint in color.

The rapid sand filter operates at a rate of about 125 million gallons per acre per day, or 2 gallons per square foot per minute; in some plants a higher rate is used. Because of this rapid rate and the volume of water filtered special provisions for frequent and rapid washing are necessary.

When the filter is first put in operation after washing, the loss of head due to friction in passing through the sand is small—perhaps a foot. As the filter becomes dirty, this increases; when it becomes as much as 7 to 9 feet, the filter must be washed. This variation in loss of head requires the use of rate controllers so that a

uniform rate of filtration is maintained at all times.

Rate Controllers—A rate controller is designed to regulate automatically the flow through the filter so as to maintain a uniform rate of discharge regardless of the amount of loss of head in the sand, or of the change of elevations of the water in the filter and in the clear water basin. It does this by adjusting the valve openings as necessary so that a pre-determined or "set" flow shall pass through them from the start of the filter run until the valves are wide open. It is a mechanical hand which controls the valve during the entire run of the filter. For best results a rate of not more than 2 gals. per sq. ft. per minute should be maintained. Higher rates may be used under emergency conditions or peak demands, but their normal or continued employment are not considered desirable.

Checking Rate of Flow Through Filters—Operators can calculate the rate of flow through the filter, thereby checking the rate controller, as follows: Fill the filter with water; shut off the influent line; determine the time necessary to filter down one foot. For example, if it requires 4 minutes for the water to drop one foot, the rate of filtration is $7.48 \div 4 = 1.87$ gals. per square foot per min. This multiplied by the filter area will give the rate in gallons per minute for the entire filter unit; and this result multiplied by 1440 will give gallons per day.

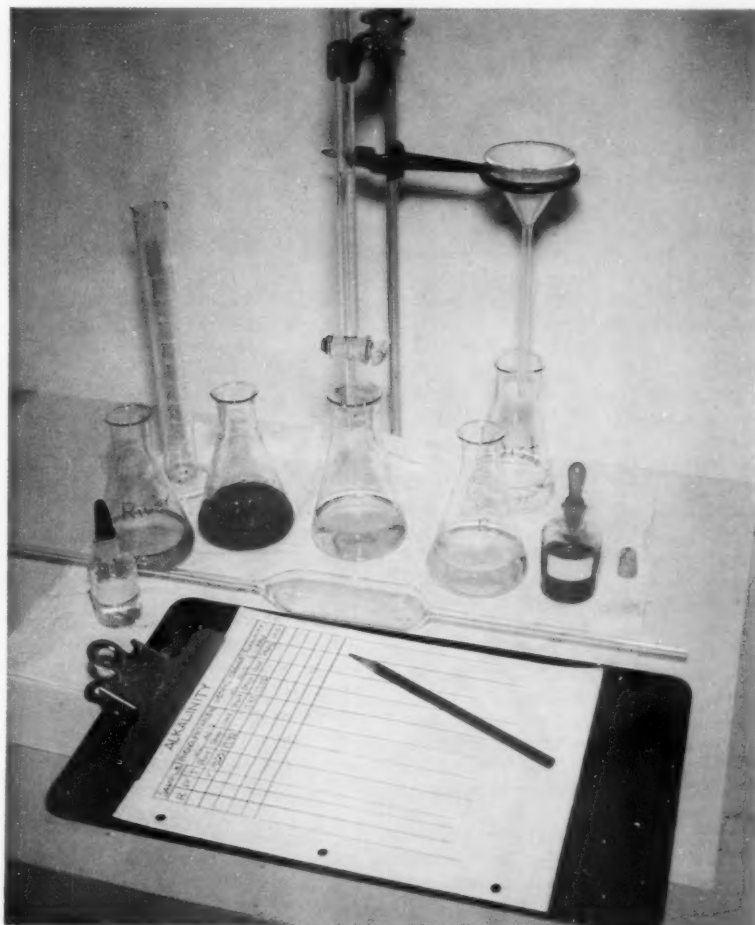
Washing Filters. When the loss of head in the filter has reached the point where washing is necessary, the influent valve is closed, and the water is drawn down below the tops of the wash water troughs, the filtered water outlet being closed. Water is then admitted slowly to the underdrain system, and then more rapidly until the usual washing rate is attained.

In most plants this rate is 15 gallons per square foot per minute, or about $7\frac{1}{2}$ times as fast as the filter rate. Also since there are $7\frac{1}{2}$ gallons in a cubic foot, the rate is 2 cu. ft. of water per square foot and the rise or upward velocity of the water is 24 inches per minute. On some of the newer plants, higher rates are used (as high as 36 gpm. per square foot). By timing the rise of wash water in the filter, the rate of wash can be determined. For instance if the water rises 2 ft. in one minute, the washing rate is 2×7.48 , or about 15 gals. per sq. ft. per min.

The upward flow of water "floats" the sand, expanding it by 40 percent to 50 percent of its volume, and

washes out the dirt; the dirty water overflows into the wash water troughs and out through the waste drain. Washing should continue until there are large clear areas in the

Surface Washers—There are several types of surface washers, among which are the Palmer revolving and the Baylis, which is stationary. Both wash the sand through agitation by



● ALKALINITY of water is determined by titration of samples with 0.02N sulfuric acid, using two indicators, phenolphthalein (small bottle on the left) and methyl orange (bottle on the right). The phenolphthalein titration measures the hydroxide alkalinity, half the carbonate and none of the bicarbonate alkalinity. The methyl orange endpoint measures all forms of alkalinity and includes the phenolphthalein figure. At the phenolphthalein endpoint the pH is 8.3; with methyl orange, it is 4.6.

wash water as it rises through the filter. Washing will ordinarily take 7 to 10 minutes. When it is completed, the wash water valve is closed; the waste or sewer valve is closed, and the influent valve is opened sufficiently to bring the water in the filter to its normal level. The effluent valve can then be opened for resumption of operation. Some operators prefer to run the filtered water to waste for a few minutes to build up a mat on the filter surface. Normally, the quantity of wash water necessary will be about 2 to 2.5 percent of the total.

jets of water. This type of washer may reduce wash water use, frequency of washing and various operating difficulties.

Measuring Sand Expansion—The upward velocity of wash water should be sufficient to expand the sand from 40 percent to 50 percent; that is, with a sand bed 24 inches deep, the depth during washing should be 33 to 36 inches. During the summer, there may be less sand expansion; even not enough to insure proper washing at the 15 gpm rate. This is due to the higher temperature and consequent lower viscosity

of the wash water, and it may be necessary to increase the wash water rate.

To measure the expansion of the sand, a sand expansion indicator may be used. Samples from the wash water trough, if placed in bottles and allowed to settle, will show if sand is being lost in washing. The loss of the finest sand from a new filter may be expected at first and is not objectionable.

Filter Operating Difficulties and Their Correction

Mud Balls—Mud balls may form in or on the sand. These generally indicate that the water applied to the filter has been imperfectly treated; or the velocity of the wash water is too low; or the time of washing is too short; or the wash water is improperly distributed; or sometimes that the rate of operation is excessive. Mud balls may be removed by scraping the sand with shovels; or sometimes during washing by skimming them off with a long handled basket of $\frac{1}{4}$ inch wire mesh. On relatively small beds, the sand may be raked during the washing process by long-handled rakes, which break up the balls. The use of a surface wash is effective in preventing mud ball formation. Proper pretreatment of the water is also essential in mud ball control.

Mud Layers—The presence of mud evenly distributed over the bed after washing, or accumulations of it near the wash water troughs indicate that wash water velocity is too low, washing time too short, troughs too high, or troughs too far apart.

Cracks—Cracks in the sand are usually due to mud being carried into the sand because of insufficient washing; but also may be due to the presence of clay or other cementing material which binds the sand grains together. A hand rake may be used to break up such areas. Proper pretreatment of the water will reduce trouble from cracks.

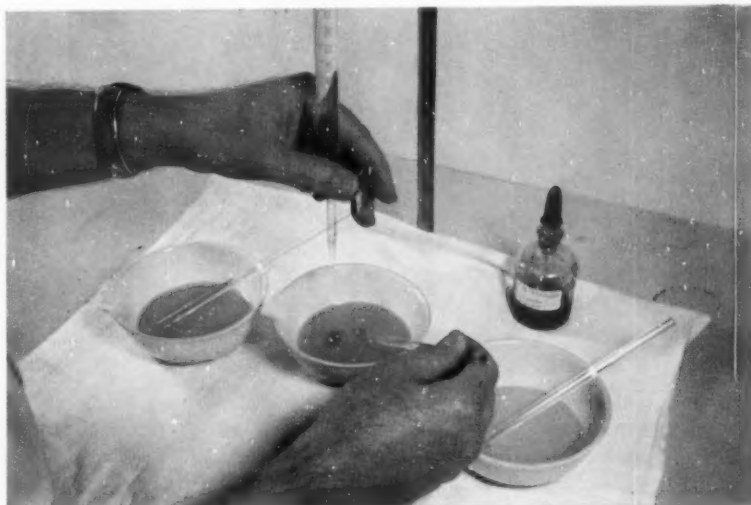
Clogging—When mud balls merge or coalesce, large areas of compacted mud may form. This results in uneven loading and operation of the filter, shortened runs, and often a poorly filtered water. Adequate pretreatment will reduce or eliminate the cause of such trouble. Deposits can be broken up with water jets; where applicable, chemicals can be used; or the sand may be washed.

Calcium Carbonate Coating — When the water contains an excess of calcium carbonate, this may be deposited on the sand grains, which are thus enlarged. Proper treatment of the water is necessary for pre-

vention. For curative treatment, samples of the sand should be tested in the laboratory to determine whether hydrochloric or carbonic acid is the more effective in dissolving the coating, and the amount required. A 2 percent solution, by weight, of sulfur dioxide is often used, sufficient in volume to fill (and cover) the sand bed. The solution is

surface and spreading flake caustic over the surface, 1 to 3 lb. per sq. ft. Water may then be readmitted and allowed to stand about 5 inches over the surface.

Chlorine also is used. It is especially effective for destroying algae or slime-producing organisms. A strong solution is prepared, and after the water has been drawn



● **CHLORIDE TEST:** Concentration should not exceed 250 mg/l, if the Drinking Water Standards of the Public Health Service are to be met. The routine use of the test provides valuable background information against industrial waste pollution of the water source. The Mohr method of determining chlorides is illustrated. Sample is titrated with 0.0141N silver nitrate solution; potassium chromate is the indicator. The color change at the endpoint proceeds from yellow to pinkish yellow.

recirculated through the filter until adequate cleaning is obtained.

Breaks in the underdrain system or in the gravel layer may result in concentration of wash water into a channel, with mounds of sand forming. Removal of the sand and repair of the underdrains are required.

Shrinkage of sand beds is sometimes due to the cementation of the sand grains by organic matter or gelatinous floc; also at times by fine clay, oil or microorganisms. Alkali treatment is usually helpful in such cases. A 2 percent or 3 percent solution by weight of caustic soda, sufficient in volume to fill the bed and cover the sand to a depth of 3 to 4 inches is used. This, if allowed to stand 12 to 24 hours, will usually prove helpful. The outlets of the filter unit should, of course, be closed before the caustic soda is added; after the solution is drained off, the bed must be washed thoroughly.

An alternative method consists of drawing the water down to the sand

down to about a foot above the top of the sand, this water is dosed to give a strength of about 3,000 mg/l. The treated water is then lowered to about an inch above the sand level, thus drawing the chlorinated water into the interstices of the sand; after about 24 hours of contact, the bed is washed thoroughly. Another method is to add chlorine to the wash water and backwash until there is at least 10 mg/l of chlorine in the water at the top of the bed. This chlorine solution is allowed to stand for 24 hours, after which the bed is washed thoroughly.

Inspection — From time to time after washing a filter the water should be drawn down below the surface of sand to permit inspection and examination.

Removing Sand—Removal of the sand and gravel from the bed is a major operation, and is rarely necessary. Broken or clogged strainers occurring in sufficient number may make sand removal necessary for repair and replacement.

How Hard Water Is Softened

The causes of hardness—calcium and magnesium compounds—have been listed. In the amounts ordinarily present in water, these chemicals do not affect health, but they interfere with the use of water for many business, domestic and industrial uses. Hardness increases the amount of soap used; reduces the efficiency of hot water heaters and boilers by depositing scale on tubes and heating surfaces; and may hinder the operation of laundries, textile plants and other industrial processes.

Softening is usually effected by one of two processes: The addition of lime and soda ash, which changes the bicarbonates and sulfates of calcium and magnesium from soluble to insoluble forms, and permits the removal of these by sedimentation and filtration; and by passing the water through a bed of zeolite, which transforms the calcium and magnesium salts into sodium compounds which do not cause hardness.

Lime-Soda Softening. Lime is added to remove carbonate hardness and magnesium; soda ash is used to remove the non-carbonate hardness. Data required are: Free CO_2 ; half-bound CO_2 which is 44 percent of the bicarbonate alkalinity; total magnesium; and non-carbonate hardness. These should be expressed in mg/l.

The free and the half-bound CO_2 are added together; 10.62 pounds of pure CaO are required per million gallons to neutralize each mg/l of free and half-bound CO_2 . The lime required to react with magnesium amounts to 19 pounds of CaO per

million gallons per mg/l of magnesium. For the removal of non-carbonate hardness, 9 lbs. of soda ash are required per million gallons per mg/l of non-carbonate hardness, expressed as CaCO_3 .

It is usual to leave in the water a carbonate hardness of 50 to 100 mg/l. In practice this amount should be subtracted before computing the chemical dosage.

Jar tests, already described, may be used to check the calculations of lime and soda ash. The chemical equations developed in lime-soda softening and methods of computing dosages are described fully in "Water and Sewage, Chemistry and Chemicals."

Recarbonation — When water is softened with lime, some of the carbonates may remain in suspension in the water, and precipitate on the sand grains of the filter or in the piping of the distribution system. This is especially the case when the excess lime softening treatment is used, which consists of overdosing the water with lime—35 to 50 mg/l excess of lime—resulting in a very rapid formation of flocculent matter.

This excess dosage of lime results in a caustic alkalinity. The addition of carbon dioxide will remove the caustic alkalinity by changing the calcium hydroxide to calcium carbonate. This is known as recarbonation.

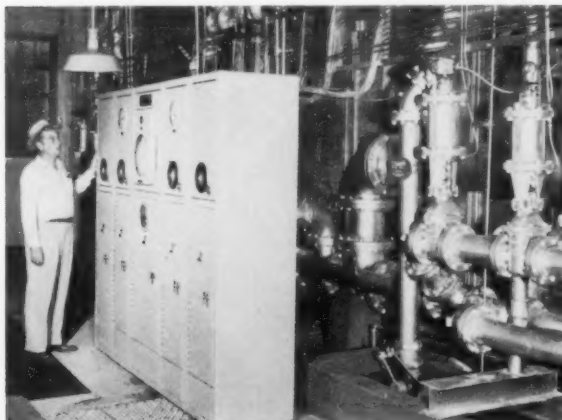
The CO_2 for the small plant is generally produced by burning gas, oil, coke or coal; stack or produced gases can be used. For burning oil, gas or coke, a small stove may be used, the gas from which contains about 10 percent of CO_2 . This gas

must pass through a washer, a drier, a trap for further removal of the moisture and a compressor or blower, which forces it through a grid or diffuser into the water. Porous diffuser plates reduce the required depth of basins and the power cost of CO_2 diffusion.

The theoretical amount of CO_2 required in pounds per million gallons is 3.7 times the mg/l of calcium carbonate; in practice 25 percent should be added to this. A plant with a capacity of 1 mgd. will ordinarily not require more than about 500 pounds of CO_2 daily or about 30 cubic feet per minute of gas. A discussion of this subject is given in *Water Supply and Treatment*, by Charles P. Hoover, published by the National Lime Association.

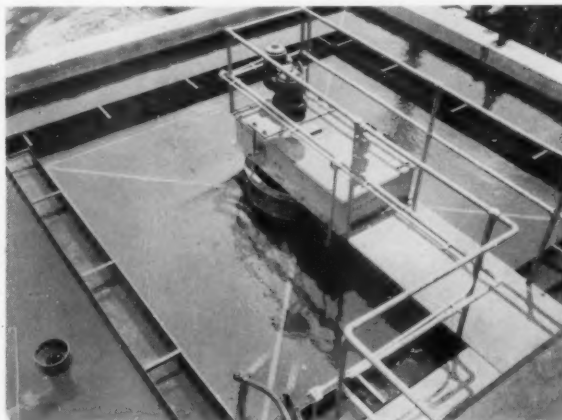
Stabilization with Polyphosphates — Polyphosphates, metaphosphates and similar compounds will prevent deposition or scaling from water supersaturated with calcium carbonate. Dosages are usually in the neighborhood of one to 2 mg/l.

Zeolite Softening. Zeolites are mineral compounds which have the ability when water is passed through them, to remove the hardness. In reality this is an exchange. The zeolites normally have a sodium base, but when water containing calcium and magnesium is passed through the zeolite, the sodium is given up and its place is taken by the calcium and magnesium which are thereby removed from the water. When all the sodium has been replaced by calcium and magnesium, the zeolite must be regenerated, which is accomplished by passing a strong salt solution through it. The calcium and magnesium are then exchanged for sodium by a brine solution and the



Courtesy Permutit Co.

● **WATER** softening is accomplished here by the zeolite process, with regeneration by salt water.



Courtesy Graver Water Conditioning Co.

● **LIME-SODA** softening may use an upward-flow type of unit. This tank, 23 ft. square, has a capacity of 600 gpm.

bed of zeolite is again ready for softening water. This process is continued indefinitely.

The zeolite is usually placed in a steel tank similar to and operating like a pressure filter. The bed of zeolite is usually 30 to 60 inches thick. The washing system is generally the same as in a rapid sand filter, though the rate of wash is usually lower—from 6 to 8 gallons per square foot per minute. The zeolites effect ion exchange, and in the last decade have become identified with a group of materials which exchange sodium or hydrogen for any and all positive ions and OH- for any and all negative ions. These are called, respectively, cation and anion exchanges.

Operation—The rate of zeolite softener operation is ordinarily 4 to 6 gallons per square foot per minute. The zeolite is not intended to act as a filter, nor to remove sus-

pended matter from the water. Consequently only clear water should be passed through the zeolite, and in the case of filter plants, softening will normally follow filtration.

The rock salt for regenerating the zeolite is made into a brine. As applied to the zeolite for regenerating, the brine should contain not more than 10 percent nor less than 5 percent of salt. In regenerating, the incoming water is shut off, the outlet closed, the unit backwashed and the brine introduced. It is either held in contact for 10 to 15 minutes or circulated slowly through the bed. Zeolites will soften water to zero hardness, but this is not often desirable, and a hardness of 50 to 70 mg/l is generally permitted. This is usually accomplished by softening completely a part of the water and mixing this softened water with enough raw water to obtain the desired results.

DISINFECTION OF WATER

None of the steps in water purification—storage, sedimentation, coagulation and filtration—nor all of them combined can be relied on to remove all of the bacteria from the water, though ordinarily less than 1 percent of the organisms may survive these processes in a well operated plant. These remaining bacteria should be removed by disinfection.

Chlorination is the final safeguard of the quality of the water. As such the necessity for its continuous and regular application in sufficient amounts to accomplish bacterial removal cannot be overemphasized. This requires good equipment; attention, care and intelligence; and the employment of proper tests and checks. Chlorine is employed primarily in the form of liquid chlorine, and in the smaller plants, as a solution of calcium hypochlorite.

"Liquid" chlorine is a gas, but under pressure it becomes a liquid in which form it is shipped in steel cylinders. The pressure in cylinders varies with the temperature from 40 to 150 pounds, being greatest at high temperatures. At 70° F, the pressure is about 85 pounds per sq. in.

Calcium hypochlorite solutions are normally prepared from calcium hypochlorite powder which contains not less than 70 percent available chlorine and is quite stable. However, when the powder is exposed to the air, moisture will be absorbed from the air and a crust will be formed on the surface of the chemi-

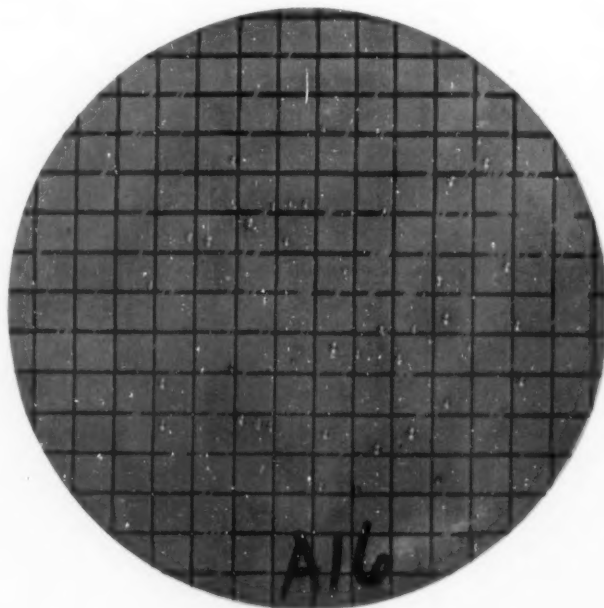
cal. Chlorine will be lost especially in warm rooms or climates, and therefore, the container should be tightly covered. When kept in tight containers, the powder may be stored for a considerable period of

time with small loss of chlorine. Ordinary chlorinated lime or bleaching powder, containing 25 percent to 35 percent available chlorine, is much less stable and loses strength rapidly when exposed to air. When chlorinated lime is stored in tight containers, the chlorine content is lost more slowly, the rate of loss being around 1 percent per month.

The requirements for equipment for applying chlorine to water are accuracy, within close limits, but most of all reliability, for if the application of chlorine fails, an unsafe water may result in serious epidemics.

Applying Liquid Chlorine. The function of a chlorinator is to take the liquid chlorine from the cylinder, measure it, and feed it constantly in predetermined amounts into the water. Application may be in either of two ways, directly to the medium being treated, as a gas; or first mixing with water and applying the resulting solution. These two methods are known respectively as "direct feed" and "solution feed."

Direct Feed Application—In a direct feed apparatus, the gas is applied through some type of diffuser, usually a carborundum stone, which divides the gas into very small bubbles, making it easily absorbed by the water.



Courtesy Millipore Filter Corp.
● APPEARANCE of colonies with a yellowish metallic luster on a membrane filter pad saturated with Endo medium any time within 20 ± 2 hrs. is evidence of coliforms.

Solution Feed Application—In this method, which is used in most waterworks plants, the gas is dissolved in a small flow of water. The pressure of this water operates an injector which applies the chlorine solution against pressure in the pipe line. In operation, a practical minimum pressure ratio is 4 to 1, or 4 pounds in water pressure to the injector for every pound in line pressure.

Operation of a Chlorinator—For proper operation, the room in which the chlorinator is kept should be not colder than 50°F. Warm gas entering a colder chlorinator will condense and may cause clogging. Therefore the chlorinator should not be placed on an outside wall, but should be in a warmer place than the cylinder or the pipe connecting the cylinder and the chlorinator. A radiator, a small stove, or an electric heater may be used to heat the chlorinator room. The chlorinator building should be insulated or well protected. Chlorine cylinders should not be exposed to concentrated heat.

Chlorine cylinders should be kept on scales and the weight read each day as a check against the amount of chlorine used.

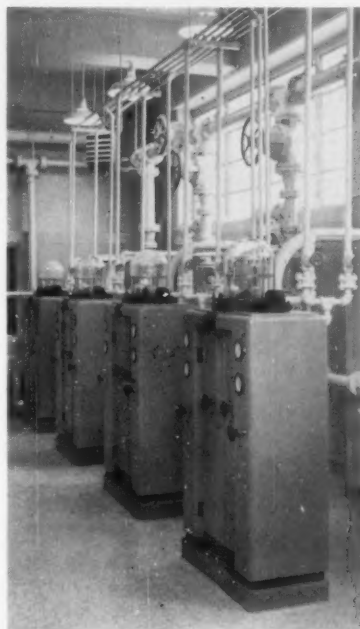
The maximum drawoff or discharge from 100 to 150 pound cylinders at 70°F is approximately 30 pounds per 24 hours, and 400 lbs. from ton containers. Due to the change from a liquid to a gas, a drop in temperature occurs and if more than 30 pounds are used daily, 2 or more cylinders should be attached. Chlorine evaporators may be used. In these the chlorine cylinder is immersed in a heated water bath, the temperature of which is thermostatically controlled.

A reserve supply of chlorine should be kept on hand; also a supply of duplicate parts, including valves, gaskets, etc. The operator should not attempt major repairs; it is far better to have an entire duplicate chlorinator on hand for emergencies.

Chlorine leaks are dangerous since the gas is an irritant to the lungs. A concentration of 1 part of chlorine in 100,000 can be noticed; 1 part to 50,000 parts of air causes discomfort; and 1 part in 1000 of air after 5 minutes exposure produces death. Leaks can be located by means of an open bottle of ammonia. Valves, connections and other places that may permit chlorine to escape are tested with the ammonia bottle. White fumes of ammonium chloride are formed when chlorine combines with ammonia. Suitable gas masks should be on hand for use in case

of leaks. Because chlorine is heavier than air, ventilation at or near the floor level is desirable.

Using Hypochlorites. Hypochlorite solutions, prepared from high chlorine content hypochlorites, are used in smaller water plants for chlorina-



Courtesy Wallace & Tiernan Co.
● FINAL safeguard of water quality is regular, adequate, chlorine dosage.

tion of the supply, and in many plants hypochlorinators are used for standby and emergency work. Sodium hypochlorite solutions may also be used.

To make 40 gallons of 1 percent available chlorine solution, there will be required 40 gallons of water which weigh 333.6 lbs. Chlorine required is 1 percent of 333.6 or 3.336 lbs. If the calcium hypochlorite powder has a chlorine content of 70 percent, then 3.336 divided by 70 percent or 4.76 lbs. of the hypochlorite powder will be required for 40 gallons of solution. As 70 percent available chlorine calcium hypochlorite is available in 5-lb. cans, a solution made by mixing one 5-lb. can of hypochlorite with 40 gallons of water may be considered as of 1 percent strength. This is not exact, but is near enough for all practical purposes.

As solutions lose strength on standing even in dark, cool places, only enough to last a few days should be prepared at one time.

Hypochlorinators—Feeding equipment for hypochlorite solutions is available in a variety of forms. The type most used is a small motor

driven diaphragm pump capable of easy variation of the stroke length, stroking rate, or both. This unit can be cross-connected on the starting switch of an electric pump so as to start and stop in step with it, thus providing automatic chlorination; or it can be plugged into an electric light socket and started and stopped manually. Other types are available for operation by water power from the main being treated, and both electric and water operated types can be obtained for control from meters. Calcium hypochlorite also can be obtained in tablet form and fed by a solution feeder specially designed for using tablets.

Computing Dosages — To chlorinate a flow of 500 gallons per minute with a dosage of 4 lbs. of chlorine per million gallons or 0.48 mg/l, using a solution containing 1 percent available chlorine, the required number of milliliters to be added to the flow per minute is as follows: 4 lbs. of chlorine is contained in 400 lbs. of a 1 percent available chlorine solution; $400 \div 8.34 = 48$ gallons of 1 percent solution per million gallons. Multiplying the number of gallons required per million gallons of water by the number of milliliters contained in a gallon (3.785), 181,680 ml of 1 percent solution are required per million gallons; or 0.1817 ml per gallon. Multiplying the requirement per gallon by the flow rate, $500 \times 0.1817 = 90.85$ ml of 1 percent solution per minute.

What Chlorine Does

When chlorine is applied to water, a portion of it reacts with organic matter; some is used to destroy micro-organisms; and some is left over. The left-over chlorine or "residual" is easily measured, and this feature is used to determine whether the disinfection action has taken place — whether sufficient chlorine has been added. The form in which chlorine is present depends upon the organic matter in the water, principally ammonia. The chlorine-ammonia reaction products, primarily chloramines, are called combined chlorine, which has a measurable residual. If more than enough chlorine is added to react completely with ammonia, "free available chlorine" results which is twenty-five times as effective a disinfectant as combined chlorine. The point at which the reaction with ammonia is completed may be determined by plotting chlorine dosage vs residuals as found when chlorine is gradually added to water. While the reaction is occurring, the dosage—residual ratio is irregular. When free available

chlorine residuals are present, this ratio becomes approximately constant. In other words, the residual increases proportionately with the dosage. This is illustrated diagrammatically in "Water and Sewage Chemistry and Chemicals."

Influence of pH. The amount of residual required for disinfection varies with pH of the water. The rate at which disinfection occurs depends primarily upon whether the residual is "combined" or "free". With free chlorine residuals, at pH 6 to 8, 0.2 mg/l maintained for 10 minutes contact time is sufficient. At pH 8 to 9, 0.4 mg/l is required; at pH 9 to 10, 0.8; and above 10, more than 1.0. If combined residuals are used, the contact period should be at least 60 minutes. The pH also influences the effectiveness of these residuals: at 6 to 7, the concentration required is 1.0 mg/l; at 7 to 8, 1.5, 8 to 9, 1.8 mg/l.

Combined Residual Chlorination. The practice of combining chlorine and ammonia for disinfection of water became quite popular long before the discovery of the advantages of extending the chlorine-ammonia reactions to the point of obtaining

may sometimes be minimized with combined residual chlorination.

If ammonia is added to the water just before the chlorine is added, the reaction between the chlorine and the taste-producing materials are prevented. The use of ammonia also permits the use of larger doses of chlorine without causing chlorine tastes. The ammonia should be applied a few feet ahead of the chlorine so as to obtain a thorough mixing of the ammonia with the water.

When this method is employed the relatively slower disinfection action must be kept in mind. Consequently, a longer period of contact—about 2 hours—is required. Water treated with ammonia and chlorine should not be used, therefore, until 2 hours after the chlorine treatment.

An advantage of the use of ammonia with chlorine, is that in small plants, without full-time attendance, where the flow or usage of water varies materially from hour to hour, and where the chlorine dosage is not regulated by automatic equipment in accordance with the volume of flow, the heavier dosages during periods of low flow are less likely to cause

be applied in a liquid form by ammoniators of the same general type as the hypo-chlorinators described above.

The dosage of ammonia required depends on the characteristics of the water. Ordinarily it is a third to a half of the chlorine dosage. When using ammonia, a higher chlorine dosage is commonly used, 1.0 mg/l or greater. Usually, combined residual chlorination should not be used unless it is definitely determined that free residual chlorination will not avoid the taste and odor problem of a given water.

Free Residual Chlorination. A free chlorine residual is highly effective in destroying organisms in the water and also is persistent. It may be effective in eliminating tastes and odors, and in destroying organic growths inside the pipes of the distribution system; but most important, from the viewpoint of safe water, is its ability to destroy bacteria and to maintain safe residuals throughout the entire distribution system. Because the end-point of chlorine-ammonia reactions to produce free chlorine is the odorous nitrogen trichloride, the water should be exposed to the air when this method is employed.

The chlorine dosage necessary to insure complete sterilization and a persistent residual, without tastes or odors, must be determined by preliminary laboratory work followed by trials on a plant-scale basis. Chlorine demands may vary according to the character of the water, seasonal and climatic conditions, and other factors. Therefore, it is desirable for a plant contemplating the use of this method of chlorination to call on the manufacturers of chlorinating equipment suitable for the work to assist in developing dosages. Bacterial destruction and the consequent protection of the consumers at all times are the most important advantages to be gained through the maintenance of free chlorine residual, but many cities report additional advantages. In most plants using this method, a free available chlorine residual of 0.8 to 1.2 mg/l is maintained on the filters.

Making Trial Dosages. Chlorine water, not hypochlorite, must be used for making a series of trial doses. A suitable solution can be obtained from a chlorinator solution hose or by bubbling chlorine through water obtained from the laboratory tap. Due to the instability of chlorine water, fresh solutions should be made up daily and should

(Continued on page 150)



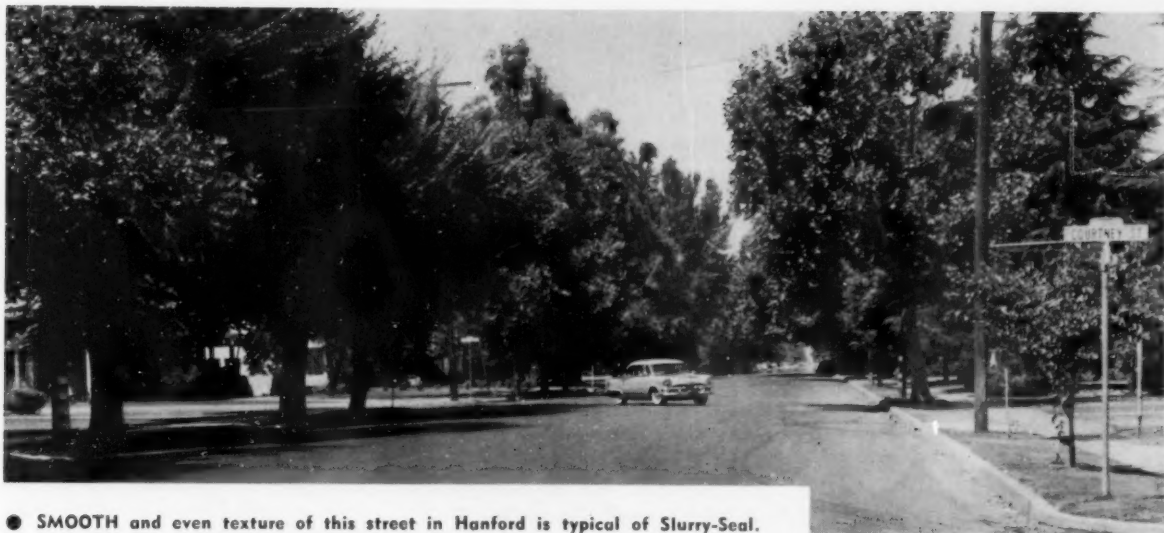
Courtesy W. A. Taylor & Co.

● THIS SET, or a modification of it, is used for checking chlorine residuals.

a free chlorine residual. While later research has detracted from the popularity of chlorine - ammonia treatment, or combined residual chlorination, it is preferred by some. The method offers advantages in avoiding taste and odor problems which occur when water containing such substances as phenols is treated with chlorine alone. Tastes and odors resulting from the presence of algae

tastes when both ammonia and chlorine are used.

Ammonia is ordinarily furnished in cylinders of the same type as are used for chlorine; and application is by means of equipment practically the same as that used for applying liquid chlorine. Chlorinators cannot be used to apply ammonia since different construction is necessary to prevent corrosion. Ammonia can also



● SMOOTH and even texture of this street in Hanford is typical of Slurry-Seal.

Today's Street Maintenance at YESTERDAY'S PRICES

CARL E. NEILL,

Staff Engineer,

American Bitumuls & Asphalt Company

IN THE SAN Joaquin Valley of Northern California, at least three cities found themselves faced with problems familiar to maintenance men in almost every community in the U.S.: Streets were deteriorating faster than they could be replaced with existing funds. These three cities (Visalia, Hanford, and Sanger) working independently, but along the same lines, recently surveyed their situation. For the most part, the streets in these cities had been paved a number of years ago with various types of asphaltic concrete or with road oil-sand/gravel mixtures. The results were the same: The streets were showing signs of cracking, alligatoring, or raveling. It was not feasible to assess property owners for the full cost of a complete new pavement. Besides, despite the fact that the surfaces of these streets were in poor shape, the pavements themselves were sound.

Following their surveys of street conditions, each of the cities carried out intensive investigation into various suggested methods for remedying the situation. All three cities

adopted the same method of meeting the problem, the application of Bitumuls "Slurry Seal" for the rehabilitation of their streets. This consisted of appropriate fine aggregates (all passing the No. 8 sieve) and a mixing grade emulsified asphalt and water, mixed to a slurry and applied by spreader box over the surfaces of the streets. All three cities chose to mix the slurry in transit-mix trucks which discharged into spreader boxes for application. However, each of the cities adopted different methods of carrying out the actual operations.

Visalia—In Visalia, for instance, the work was contracted and was performed by the George Reed Co. of Modesto, California. In setting up specifications for the work, "Ernie" Dunn, City Manager, and Harry Tow, City Engineer, arranged for the purchase of Bitumuls Slurry Seal by the ton (a ton included 2,000# aggregate plus 36 to 44 gallons of binder in addition to the water required for consistency). There was an additional item for application, based on the area covered. This arrangement permitted variation in the rate of application, depending upon the condition of the street under treatment. For this particular work, the contract price for slurry was \$17 per ton.

The application price was \$0.03 per sq. yd. for a total area of 78,000 sq. yds. Contractors averaged 180 to 225 sq. yds. per ton. It should be noted here that these prices should not be considered standard since the price of slurry sealing work varies according to local conditions.

Hanford—In Hanford, the Street Maintenance Forces built their own spreader box under the direction of George Minturn, City Manager, and "Ike" Scheeringa, Street Superintendent. They then purchased the necessary materials, delivered to, and chuted into, the spreader box by transit-mix truck. The city forces applied the material.

Sanger—In Sanger, the method used was similar to that adopted by Hanford; but in this case, most of the application was made over oil-mixed streets which had seriously raveled. While Visalia and Hanford had used similar aggregate (consisting of a 50/50 blend of fine crusher-dust, $\frac{1}{8}$ " minus, and a fine plaster sand), Sanger elected to use a $\frac{1}{4}$ " minus crusher dust. Doug Flautt, City Manager, and Ed Cameron, City Engineer, supervised the work for the City of Sanger.

Batching the Slurry

The required amount of water and Bitumuls was added to the



● **BITUMULS** slurry being chuted into spreader box from transit truck in Visalia. Methods used varied in several details from place to place as described in the text.

transit mixer. In all cases, aggregate for the slurry was batched through a standard concrete aggregate batching plant, which permitted the material to be weighed as it was batched into the truck. In this way, an accurate measurement of the amount used in each load was easy to obtain.

All of the cities used spreader boxes that were similar in basic design for the slurry seal application. In general, such a spreader box consisted of an open rectangular timber box, approximately 10 ft. in width. About 2/3 of the way back in the box an adjustable squeegee was mounted. The squeegee was hinged at the quarter points to permit adjusting for the crown of the pavement.

However, many little refinements were developed by ingenious City Engineers, Street Maintenance Superintendents and Shop Mechanics; and each of these additions contributed to the overall efficiency of the job. For example, on some of the boxes a water spray-bar was mounted across the front of the box and fed by a hose from water tanks on the mixer truck. This permitted dampening the pavement just ahead of spreading.

Another example was the box at Visalia which had a "retractable" wheel mounted on each corner. This permitted the contractor, George Reed, to lower these wheels and move the box rapidly from place to place. At Hanford, the box was drawn by a rubber-tire tractor equipped with a specially developed rigid hitch and hydraulic hoist for lifting and transporting the box rapidly and easily from one location to another.

At both Hanford and Sanger, arrangements were devised to permit fast and accurate adjustment of the squeegee, both for thickness

of application and for conformance to the crown of the pavement.

Preparation and Application

Ahead of actual application, in all cities, the streets were carefully cleaned. For instance, in Visalia, all cracks were blown out with air and the streets were thoroughly washed and swept by city equipment. Engineers in Hanford used a high-pressure water jet to clean the cracks, then power-broomed the streets. These preliminary preparations paid off by developing better penetration of the slurry through the cracks, and are highly recommended on all applications.

In planning the work, several blocks of streets were closed to

traffic prior to application of the Bitumuls slurry seal. As soon as cleaning operations were completed, the transit mix trucks moved in with the slurry and chuted it into the spreader boxes. Working in tandem, the mix truck and spreader box moved rapidly along the pavement, filling cracks, doing some minor levelling, and sealing the surface of the street. Average thickness deposited varied from 1/16" to 1/8" depending on the old pavement condition. In almost every case pavement was open to traffic on the following morning.

Less Cost for Sealing

In reviewing the work done to date, the officials in all three cities are quick to point out major advantages of Bitumuls slurry seal. First, they mention the low cost of this method of rehabilitating deteriorated pavement surfaces. Second, they cite the satisfactory seal for the pavements, with no loose material on the surface. Third, they are particularly enthusiastic about the fact that the low cost avoids additional tax burden on property owners. (Yet, at the same time, the property owners feel that the improved streets increase the value of their property.) To date, all sealing has been accomplished without any increase in tax rate and a high percentage of city streets have been rehabilitated in an extremely short time.



● **BATCHING** plant at Visalia. In all cases, aggregate for the slurry was batched through standard batching units, permitting the material to be weighed for each load.

SANITARY FILL

by the RAMP METHOD

JOSEPH E. SKORNICKA, JR.,

Drott Manufacturing Corporation,
Milwaukee, Wisconsin

SANITARY LANDFILL operations will vary in different parts of the country. There is no formula that will give a complete answer. What is required is a survey of each community in question, a common sense analysis of the individual needs and the application of already proven methods. Information generally required is population, a key to refuse volume estimates if the volume figures are not available; information on types of refuse, industrial and private; available land area, type of soil and topography. In the past, several methods of operation have been used. There appears to be one method of operation which has proven to be effective and efficient, yet requiring a minimum of earthmoving and excessive tractor travel. It is the ramp method of operation, a method developed and refined by the Corps of Engineers when the Drott Manufacturing Corporation first started working with them.

The Operating Sequence

Cells of refuse are progressively developed; the level of the terrain is raised; and refuse is thoroughly compacted and covered with a minimum of dirt moving. The ramp method of operation lends itself to almost any type of terrain. A ramp can be constructed in a matter of an hour if the natural lay of the land does not form any possible ramp. Important also is the fact that cover material need be moved only once. The steps in a ramp operation are: 1—Material (garbage and refuse) is dumped either at the base of or on the working face of the ramp. 2—This material is spread and then compacted along the ramp to about one-fourth of its original cubic



● DROTT 4-in-1 Skid-Shovel building a sanitary fill in Montpelier, Vermont. When not working on the fill, this unit is used for street repair and other jobs.

Sequence for Filling Pit, Hole, or Side of Hill:



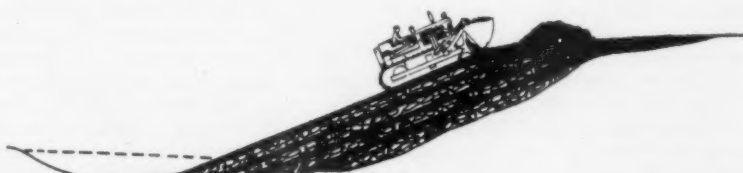
● DIRT moving or other advance preparation is not necessary. Refuse is dumped near the base of the slope where compacting is carried out with tractor and Bullclam after every few loads of refuse have been dumped. If an access road is necessary to permit passage of refuse trucks, the bullclam can readily construct this.



● AFTER refuse has been thoroughly compacted by passing tractor back and forth over it, it is worked against the side of the slope so as to form a ramp with a slope of about 30 degrees, and in this position additional compaction is provided. This general procedure is repeated throughout the day as additional refuse arrives.



● CLEAN earth for the daily cover is procured at the base of the ramp and is spread in smooth layers about 6 inches deep up the ramp, sealing off the deposit for the day. The tractor always works toward the ramp. The depression or trench resulting from borrowing the dirt provides added space for additional deposits.

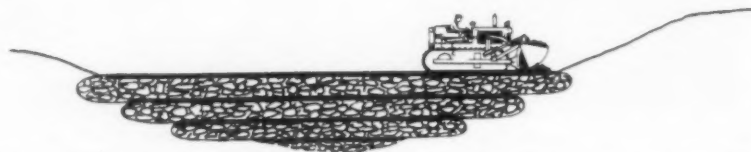


● FINAL cover is stockpiled at the top of the ramp and, as the completed cells move outward, the stockpiled topsoil is spread over the top. It is helpful to use grade stakes to maintain the proper slope at the top of the completed fill area.

Filling Flat Land or Long Ravines



● WHERE no slope exists, as on level ground, a mound of dirt or of refuse can be formed, using about a 30 degree slope. The height of the ramp or ridge can be varied to provide the height intended for the final level of the area. After this artificial slope is provided, procedures outlined on the preceding page follow.



● RAVINE FILLING: The refuse is deposited in the base of the ravine or gully, is thoroughly compacted and is covered with the usual 8-inch layer of dirt which is obtained from the side slope. When the low area is filled sufficiently, the final 2-ft. cover is placed over the layers of compacted refuse to seal it off completely.

measure. 3—Material for cover is then dug from the area immediately in front of the compacted cell or refuse, being handled only once. 4—Compaction also is taking place as the cover material is being spread. 5—The next cell is formed by dumping refuse over the face of the just completed ramp or at its base. This simple operation is continued until the desired level is obtained.

With the ramp method of operation it is most important that the working face have an angle of no more than 30 degrees. If the site is an abandoned quarry or clay or gravel pit, or if other excavated area is available, landfill will serve the dual functions of disposal and reclamation.

In considering the questions which most frequently arise concerning any sanitary landfill operation, the first is what size city, based on population, can use sanitary landfill most efficiently and economically? We have found over the last 10 years that communities in all population groups are successfully using the sanitary landfill method. In recent years, such progressive cities as Houston, Texas, have initiated programs to supplement existing incinerator operations. The only questions are the number of equipment units; the sizes required to handle conveniently the volume; and the number of sites to hold haul distances to a minimum.

Where suitable land is available and other conditions are reasonable, sanitary landfill has proven itself to be a most economical method of disposal. Also, an attraction to many communities with numerous low areas is the fact that the fill site can

be moved in a matter of a day without trouble. Sites can be chosen on the basis of one long term reclamation program or of a series of short term operations.

For the community with a pressing disposal problem, landfill offers a speedy cure. All that is physically required is an operator, a tractor, and available land. For the smaller community, an engineering study is not usually required. Under normal circumstances, land should be chosen which would allow for a minimum of 5 years of operation, unless special conditions call for a series of short term sites.

Initial training of the operator is most important. Good tractor operation and a complete understanding of the planning are essential. The operator should be thoroughly familiar with good compaction methods, including placement of cover, and he must have an eye to drainage of the area. The fact that a man is able to operate a tractor is not an ironclad guarantee of a successful landfill operation. The job requires competent personnel. Supervision of the dumping, positioning of the trucks, and tractor maintenance belong to the operator unless the operation is of such size that more than one man is present at the site.

It is not our purpose to go into the various methods of raising money for such an operation, rather, to point out simply the fact that initial investment is well within the range of practically all communities, no matter what size. A town of 10,000 population can purchase a piece of equipment to handle the job adequately for as little as \$10,000. Land is usually available and

other expenses, such as a structure to house the tractor, a fuel storage tank and wire fencing to surround the immediate working area, are small. For the small community, used equipment may be the answer. Appropriations may often be obtained without need of bond issues.

Experience has shown that, if the public is informed of such a project through newspapers, shown any of the fine films available through equipment distributors and manufacturers and invited to take part in open hearings or see an actual demonstration, resistance to such a project can often turn to strong support and enthusiastic endorsement. An opportunity to point out the desirable points of landfill will serve to aid the promotion.

Sanitary Landfill Advantages

What, briefly, are the advantages of such a disposal method? 1—It is a method of complete disposal, handling both combustible and non-combustible materials; no unsightly dumps need to be maintained.

2—The investment in original equipment is low. When proper equipment is used initially there is little necessity for purchasing additional equipment unless there is a marked growth in population. To operate at maximum efficiency calls for the purchase of equipment built specifically for a sanitary landfill operation.

3—Low operation and maintenance costs. Two of the major factors contributing to this low cost are the reduction of truck haul miles by the location of fills at different sites, and the elimination of a double collection system. Both garbage and refuse can be picked up simultaneously without any later sorting required.

4—Flexibility. A properly regulated and operated fill can be located near residential sections without any nuisance. Properly operated, the landfill need not have any fly or vermin problem. Flexibility to population changes is also important. Daily variations in waste need not affect operations. If growth is too great, either an additional machine can be put to work or one larger machine can be used.

5—Reclamation of land. Many areas of submarginal or waste land have been improved, often increasing the value of surrounding property and going a long way towards recovering part of the initial investment. Many municipal recreation centers, playgrounds, parks, and airports are the end products of well run sanitary landfill operations.



R. L. SMITH
and

H. C. LEIBEE,

Consulting Engineers,
Saint Paul, Minnesota

● FILTER, 66 ft. in diameter, is covered with prestressed concrete dome.

COLD WEATHER WASTE TREATMENT PLANT

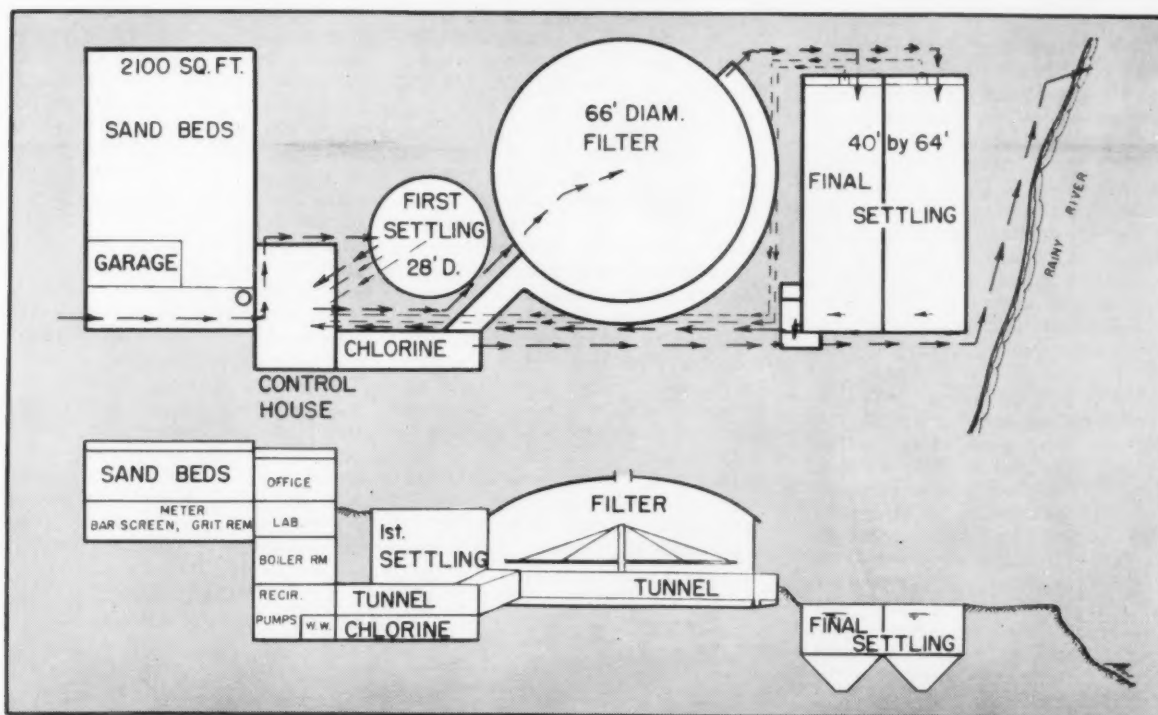
EXTENSIVE USE of the Rainy River and the Lake of the Woods for fishing has made the community of International Falls, Minn., extremely conscious of pollution, and this opinion was expressed in the decision by the City Council to construct a waste treatment plant. The old system of sewers was of the combined type, and the new construction included a complete divorcement of the two types of wastes by the construction of a separate storm water sewer system.

Bids were taken on December

19, 1955, and the plant construction was completed in the fall of 1956. The low principal bid was \$301,370 or \$52,010 under the lowest alternate bid. It is interesting to note that, based on the actual bid prices, a design for primary treatment alone, using separate sludge digestion would have cost approximately as much as the complete treatment plant using chemical treatment of sludge. The design equivalent population is 10,000 people; the normal design average flow is 750,000 gpd; the normal design peak flow is 750

gpm; and the extreme peak flow is 1,500 gpm. The raw sewage has a BOD of about 300 ppm.

The City Council authorized the construction of a complete treatment plant, rather than a primary treatment plant for the following three basic reasons: 1) The cost of both types was practically identical and, in terms of degree of treatment to be obtained, the complete treatment plant represented a value approximately three times the value to be obtained had the primary treatment plant been constructed;



● PLAN and profile of treatment plant, showing sand beds for sludge disposal, control building and other treatment units.

2) A community has no legal right to the use of public waters for treatment of a polluting waste unless the community has done everything reasonable to eliminate pollution—in this case there was only a slight economy to be obtained in the up-keep cost, and this could not be used as a justification for permitting two-thirds of the pollution of the community to remain in the river; and 3) A community, wherein a material share of its income is derived from fishermen, cannot afford to overlook the criticisms caused by emptying its wastes into potential fishing waters.

At the time of the determination of the degree of treatment, considerable study was given to the use of primary treatment with chlorination. Recent opinions, given by an extensive group of bacteriologists, indicate that both viruses and pathogenic bacteria can live for long periods of time under such conditions as exist in the Rainy River, where the water remains turbid and non-transparent to radiations from the sun. The question of the creation of sterility by chlorination of a primary treatment effluent or of a complete treatment plant effluent would appear to be all in favor of the latter. In the case that no chlorination was to be provided, the health protection conditions would be all in favor of the complete treatment plant.

The Treatment Plant

The cost of the complete treatment plant was extremely reasonable for the conditions at the Falls. Neither coarse nor fine aggregates were available locally and had to be hauled about seventy miles; and all equipment shipped in included high freight rates. The cost per equivalent capita of \$30.60 compares with a cost figure of about \$25 per equivalent capita in the southern part of the state.

The plant was constructed entirely of monolithic concrete, using air entrained Portland cement. Insulation was limited to roofs. The sand beds, garage, bar screen, grit removal mechanism, meter, control house, filter and tunnels were all housed. The plant was so constructed that practically all operations can be performed from inside the buildings. The only exception is the removal of scum from the two settling tanks. The use of this type of monolithic concrete construction was dictated by extensive experience. It is our opinion that this form of concrete, using either air entrained or non-air-entrained Portland cement, is the most resist-

ant to the action of the condensed sewer gases. The air contact points of the filter, or other units where the gases can condense, are the usual points of trouble.

The plant is of the complete treatment type, having a primary settling tank; high capacity tile media biological filter; final settling tank; chlorine contact tank; and treatment of sludge by means of a quick mix tank, addition of anhydrous ferric chloride and dewatering on sand beds. The control house has four floors. The top floor has the chlorinator room with provision for storage of cylinders; the office, including the electrical control panel; and a rest room with toilet and shower facilities. The floor below has a complete laboratory; the floor below the laboratory is the boiler room and includes the work-shop; the bottom floor includes the recirculation wet well, the recirculation pumps, the sludge pump and the sump pump. The four pipe lines to the sludge and scum discharges in the primary tank and the two hoppers in the final settling tank are operated by levers, and shafts are placed on the top floor and connected to the valves.

The primary settling tank is of the Spiraflo type, 28 ft. in diameter and 15 ft. deep. At the design flow, the surface overflow rate will be 1,200 gals. per sq. ft. per day. This rate jumps to 1,800 and 3,500 gals. per sq. ft. for normal peak flow and extreme peak flow conditions. In terms of holding period, the normal average flow holding time is two hours; during peak flow the holding is 1½ hours; and during extreme high flow, it is 45 minutes. The long holding time has a definite disadvantage during extreme cold weather in that the sewage becomes chilled during low flow periods.

The filter is 66 ft. in diameter and has 6 ft. of tile media. The use of a design loading of three pounds of BOD per cu. yd. of media will permit of a very appreciable economy by the use of this media. The filter is housed with a concrete dome of the prestressed type. The capacity is 1,500 gpm.

The final settling tank is of the standard rectangular type, having two compartments, each 20 ft. in width and 64 ft. long. All liquor

returned to the filter is passed through the full capacity of this tank which has an overflow rate of 800 gals. per sq. ft. per day at 1,500 gpm.

The sand bed room is divided into eleven beds approximately 10 ft. by 20 ft. each. These beds drain back to the incoming flow channel. The sand bed housing has a flow channel that includes the bar screen with macerator, the grit removal mechanism and the flow meter. The use of a grit removal mechanism was dictated by the fact that the sanitary sewer system was old, with poor joints, and the elimination of grit from the operating units would make for better operation.

Chemical treatment of sludge is a method that has been in use for twenty years, and there are about twenty-five operating plants. The method has certain virtues and certain faults. At International Falls, only about \$2,000 is in jeopardy in the sense that the process could be abandoned and a new one installed. The only unusable parts of the process are the quick mix tank and the 6-in. concrete block bed partition walls. The cost of chemical in a community the size of this one will normally approximate \$10 per day but the present operator is experienced in this form of treatment and will use much less than this figure. The haulage of sludge will cost approximately one dollar per day. The process has a very low initial cost; at International Falls it produced a saving of \$50,000 over conventional methods. The process is fundamentally sound in that it removes the solids from the sewage and does not permit of the return of these solids in solution to the plant. The process consists of pumping the sludge to the quick mix tank where anhydrous ferric chloride is added at the rate of 2½ pounds per one hundred gallons, the mixture is stirred twenty seconds and then passed to the sand beds for dewatering in less than twenty-four hours. The normal chemical addition results in a very low pH, and substituting copper sulfate for fifteen percent of the anhydrous ferric chloride will produce a 99.8 percent kill in the bacterial population. An increase in the amount of copper sulfate will increase the kill.





FROM HORSES TO HORSE POWER...

Where to Hitch is Still the Question

ALL CITIES have parking problems and Kinston is no exception. Some authorities try to sweep their troubles under the rug but the humps are still noticeable. Action is the answer.

Some fifty years ago a hot session of the City Commissioners was devoted to passing an ordinance which forbid the hitching of horses and mules in such a manner as to obstruct sidewalks. As a relief measure, the tobacco warehouses were made available to shoppers during

R. R. ROBINSON,

City Manager,

Kinston, North Carolina

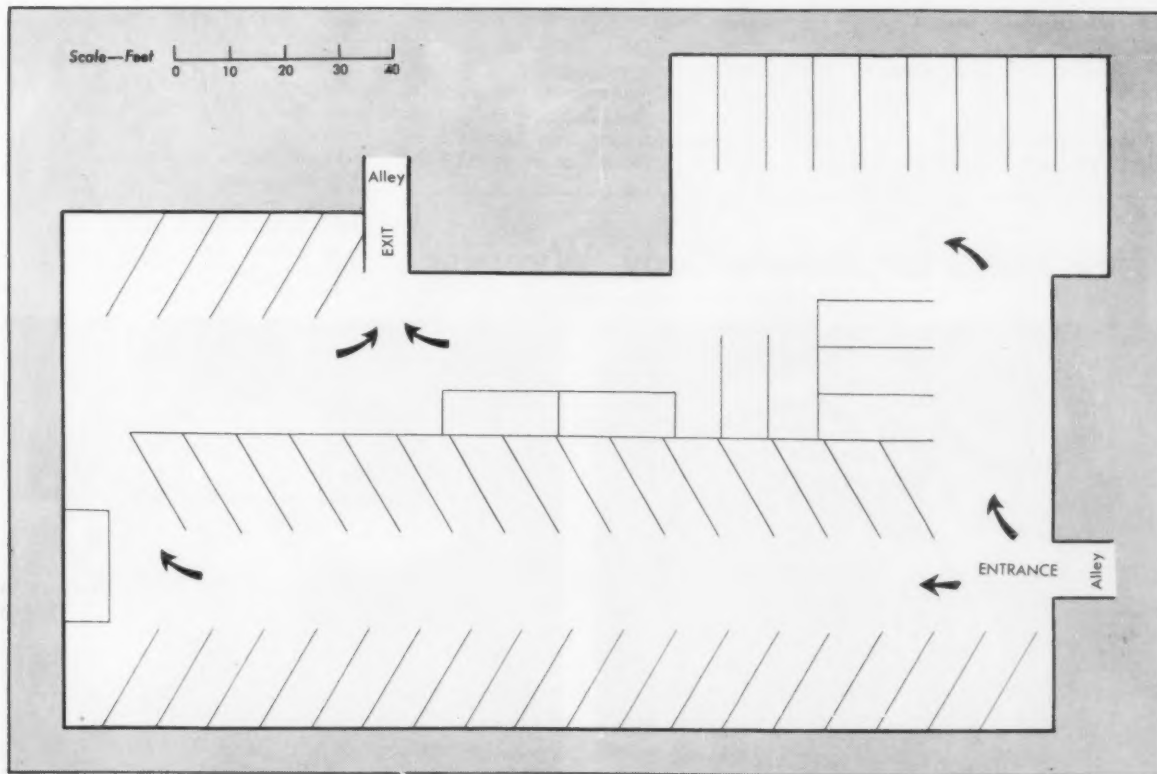
the off season. In like manner a modern cooperative effort is underway to provide off-street automobile parking.

Prior to three months ago we had no metered off street parking. Our facilities consisted of two improved

lots for weekly rentals, one improved lot with attendant and two unimproved lots with attendant plus 448 metered curb spaces.

Our City is growing fast, from a population of 18,500 in 1950 to an estimated 26,000 now and our merchants had been told that the lack of adequate off street parking was hurting business. The State report on sales tax returns forcibly proved that sales were declining.

The merchants first request was the usual one that the City do some-



● TWO OF five existing parking lots are shown in the plan and in the picture above. These provide 331 off-street places.

thing to provide off-street parking. Our business area is controlled by a very few owners and land value is very high so that it was impractical for the City to assume the financial burden of purchasing property, tearing down buildings and improving areas for parking.

After several meetings the problem was turned over to a committee of merchants and councilmen who came up with a workable joint venture. Owners of property in suitable locations were to provide the property completely cleared, drained and black topped. The City agreed to purchase and install meters on a standard contract with 50 percent of revenue to the manufacturer and 50 percent to the land owner; the City provided collection and policing. The City becomes sole owner of the meters and after they are paid for the property owner will receive 80 percent of collections and the City 20 percent.

Recognizing our problem, the City in its July budget had allocated \$5,000 for a street and traffic survey and William Babcock and Associates of Chapel Hill had been retained to do this work. In connection with our study the State Highway Department had agreed to do an Origin-Destination survey at the perimeter of the City.

At the August 6th council meeting an ordinance was passed setting up machinery for off-street parking; September 3rd an ordinance was passed to provide through truck routes; and on October 4th a preliminary report on the traffic situation was made to a joint meeting of

the Council and Planning Board. Mr. Babcock was blunt in reporting his findings and stated that we were far behind in our parking facilities and faced strangulation in the main business district.

The study determined that there were 675 curb parking spaces within 600 feet of the central business area with 448 meters installed. Use of spaces was between 16 percent and 90 percent and there were 1,000 curb parking spaces within 1,000 feet of the central business area. The recommendation was to start immediately acquiring 300 additional off-street parking spaces and install 250 more two-hour meters to push the downtown workers further out and provide space for peak shopping days.

Results of these findings really startled our merchants and by the first part of December we had in operation three metered lots of 34, 34 and 54 spaces. We have ordered 250 new meters for street installation in January. In August we hired our first patrolwoman for meter checking and this stepped up enforcement has provided better use of our street spaces. There is under consideration an area for 53 more metered spaces and efforts are being made to persuade the owner of the present unimproved lots to grade and blacktop them for all weather use.

Income from each of our 448 street meters averages \$5.20 per month; this revenue is not allocated but goes to the general fund. Receipts for the first month from the first metered lot averaged \$7.50

per meter. This was from the best location in the rear of a Sears store. It is not expected that the property owners will become wealthy from these receipts but the return is about net as they are taxed on the basis of vacant land.

Lots are equipped with Duncan model 60 meters which take nickels, dimes and quarters. Timing is set for 1 and ½ hours for five cents and the meters register up to ten hours so that all day parkers can be taken care of although the weekly rental lots get most of this business. Layout of the spaces is standard 9-ft. by 20-ft. and the bumpers are pre-cast concrete lagged into the paving.

We are concerned about the length of our leases as we were able to get them only for two years or until the meters are paid for. The meters can be used for replacements if we lose the lots but should the availability of parking generate a demand for building we would only complicate our problem. Desirable leases should run for at least ten years.

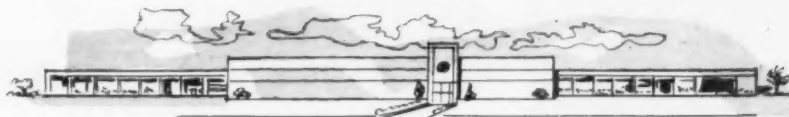
In collaboration with the Whitaker Business Service we prepared a mailing piece showing the location of lots and a description of service.

One additional point was driven home as a result of the Origin-Destination survey. Our people had been of the opinion that through traffic was causing a lot of our congestion. In connection with this survey a traffic count was taken on our principal streets. This count determined that most of the congestion was caused by local traffic circulating within the corporate limits. We cannot change the streets and therefore better channelization and one way streets must be developed for better traffic flow.

New Lights for Historic Cody, Wyoming



● BEFORE-AND-AFTER views of Cody's main street. Westinghouse OV-60 mercury-vapor luminaires were installed recently.



Measuring SEWAGE FLOW FROM SCHOOLS

IN PLANNING waste disposal facilities for two existing schools, we decided to measure the flows so as to have reliable data. A liquid level recorder, air tank and V-notch weir were placed inside a manhole. The paper charts used to record the flow buckled because of the moisture in the manhole. This problem was solved by using rubber cement to fasten the charts to a very thin sheet of tin. It took two men half a day to make the weir and recorder installation. The charts covered 24 hours and had to be changed daily. The clock ran 60 hours and over the week-end there were two recordings on the same chart.

The Wilmore-Davis grade school, one of those studied, had no other connections to its sewer line and there was no ground water problem. This school had 437 pupils with 13 toilets, 3 urinals, 2 service sinks, one dishwasher, 10 drinking fountains, 13 class rooms, 14 lavatories, 2 wash fountains, a kitchen sink and a household type garbage grinder. Metered water use in October was 44,000 gallons and in November 38,000 gals. There were 18 days in October when the school was in session, giving an average use of 2444 gals. per school day.

The average daily flow of sewage was 1945 gallons, equal to 4.36 gallons per pupil. The flow occurred between 7:30 am and 5:30 pm, with some very minor flows after those hours. There were high peaks at recess time—10:00 to 10:30 am, noon and 2 pm.

The Wheatridge High and Junior High School is on a sewer line which has some other flow from a greenhouse, one residence and a fire station. With allowance made for these, the average daily flow was 5549 gallons with an attendance of 1430, representing 3.88 gallons per day per pupil. The metered use of water was 170,000 gals. for the month while the measured flow was 117,735 gallons. There was a high fixture loss during off-school days not considered in this amount.

The difference in the amount of sewage per pupil between the two

CARROLL H. COBERLY

Coberly-Leffel Engineers, Inc.

Wheatridge, Colo.

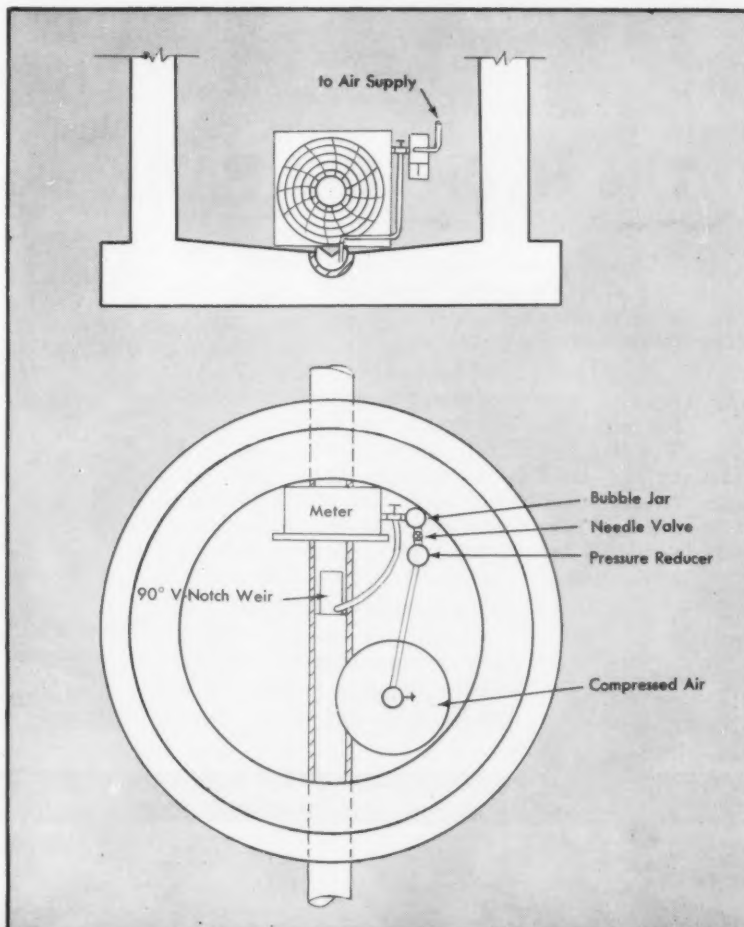
schools can be accounted for only by assuming that younger children use the various facilities more often than the older ones. By the time children reach junior high school, it may be assumed they have reached the adult stage so far as use of toilet facilities are concerned.

The peak flows appear to last for only a few minutes and therefore should not affect treatment plant

operation seriously, if at all. There appears to be a certain amount of transfer of use from the home to the school. This would not affect overall community treatment plant operation but might affect individual sewer line volumes.

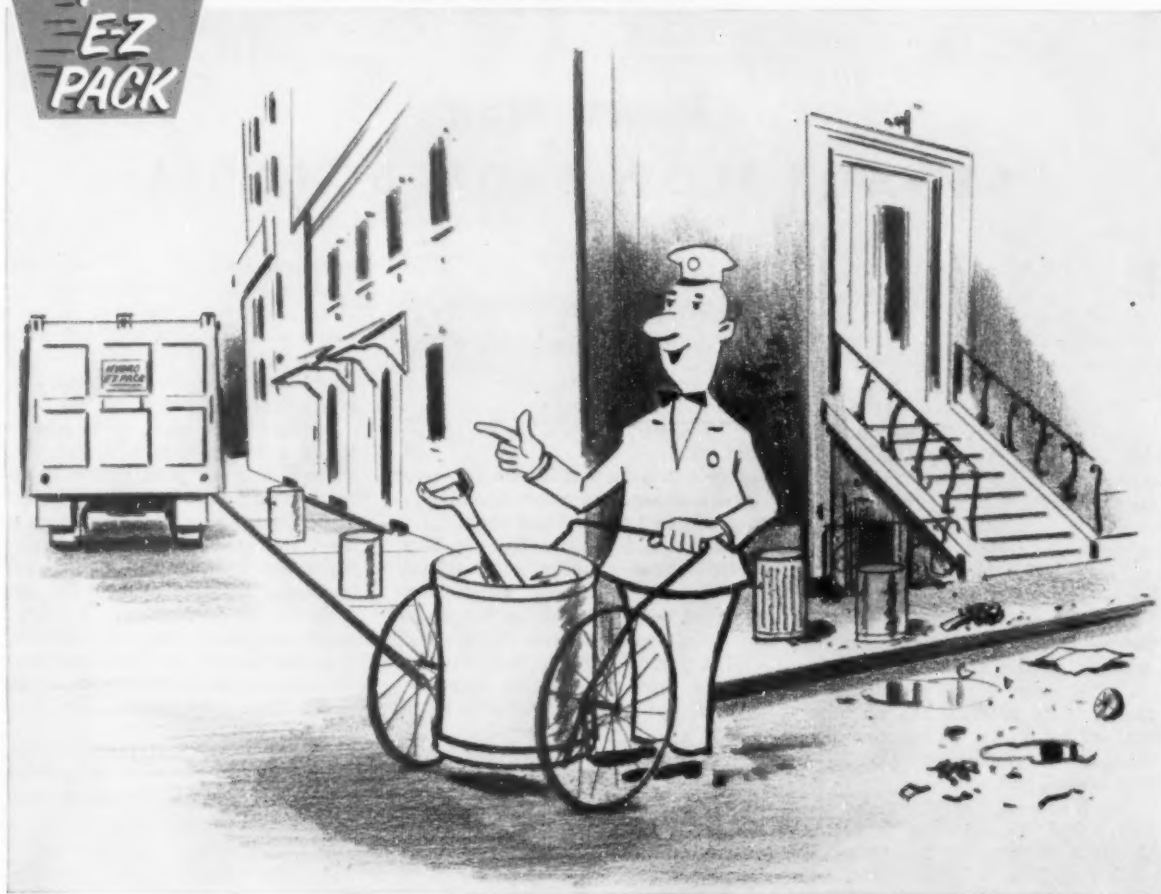
In the High schools there appears to be a time about 5:30 pm when there is a broad peak, probably due to shower time after athletic practice. There is also some evening flow. In both schools, there was a night flow, ranging up to 6 gpm, and indicating fixture leakage. In general, the schools operate 5 days a week and part time on Saturday. The schools use the facilities about 200 days a year, or about 55 percent of the time.

● **EQUIPMENT** used to measure sewage flow from two schools. Liquid level recorder, air tank and V-notch weir were placed inside a manhole as shown in this drawing.





refuse collection bodies



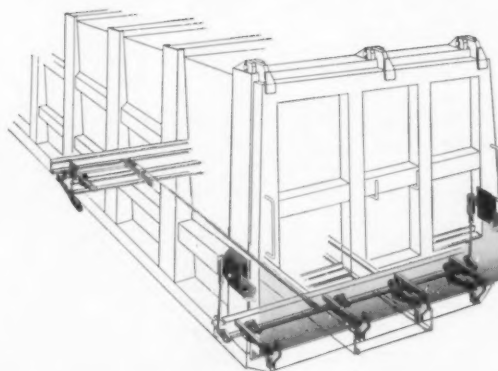
The Hydro E-Z PACK went that way!

There's no need to endure streets littered with bits of refuse and contaminated by puddles of filthy liquids left behind by leaky, unsanitary refuse collection units.

Hydro E-Z PACK bodies are absolutely liquid-tight . . . have no openings through which operating mechanism can drag refuse onto the street! The E-Z PACK tailgate seals leak-free, held tightly closed by an exclusive single lever-controlled latching mechanism. And, the E-Z PACK will hold hundreds of gallons of liquid . . . has a fast-emptying sump for quick, complete draining at the dump.



A demonstration will prove that Hydro E-Z PACKS can provide sanitary refuse collection on your routes. Call your distributor, or write to Hydro E-Z PACK Co., Galion, Ohio. AA-5901

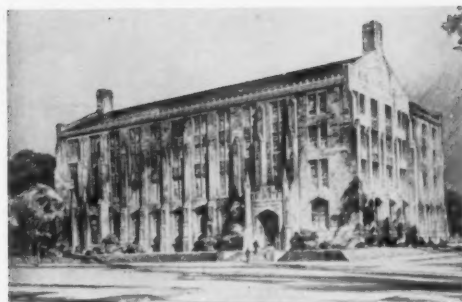


Here's an E-Z PACK exclusive! Single lever control speeds tailgate operation . . . 6-point latching assures leak-proof sealing. Best of all, you can unlock the tailgate AFTER the E-Z PACK is over the unloading pit . . . approach ramps stay clean and uncluttered!

Hydro E-Z PACK Company • Galion, Ohio



News BULLETINS



AMERICAN PUBLIC WORKS ASSOCIATION, 1313 EAST 60th STREET, CHICAGO 37, ILLINOIS

Evaluation of Sanitary Landfill Operations

37 Percent Get "A" Rating

Chicago, Ill.—Leo Weaver, Sanitary Engineer in the USPHS and Secretary of the APWA Refuse Collection and Disposal Committees, is the author of an article which gives the results of an evaluation program covering sanitary landfills. His article, which appeared in the March, 1957, issue of the Association's monthly news letter, points out the significant rise in the use of the sanitary landfill method of refuse disposal. From fewer than 100 cities using this method in 1945, the number rose to 1,000 in operation in the United States in 1956. In the peak year, 1953, some 150 cities adopted this method. In 1956, it is estimated, about 80 cities started sanitary landfill operations.

It has been difficult to make qualitative measurements because of the lack of standards for evaluation purposes and because of the magnitude of the actual testing job, assuming standards were adopted. However, an evaluation program of the landfills reportedly in operation was accomplished through the cooperation of the Public Health Service Regional Offices and the State Departments of Health. Landfill operation was classified according to the following system:

A—Operated without public nuisance or public hazard, covered daily and adequately, no deliberate burning practiced;

B—Operated without public nuisance or public health hazard, but

location permits certain modification of Class "A" operation, such as the burning of certain types of wastes at the site, or covering the fill only three times a week;

C—Operational techniques that permit development of public nuisance and potential public health hazards, such as fly breeding, rodent sustenance, malodors, etc.;

U—Unknown

	Rating	Number of Cities	Percent of Total
0			
100			
200	A	372	37
300			
400			
500	B	284	29
600			
700	C	169	17
800			
900	U	174	17
1000			

● EVALUATION of sanitary landfills operated in U.S., Jan. 1957. Text explains the rating system used to determine the various classifications.

Each State Department of Health was asked to rate each landfill operation in its State. The results of this program of evaluation are presented in the accompanying diagram. It is interesting to note that of the 825 operations classified as either A, B, or C, 45 percent fell into the "A" category. 20 percent were given "C" ratings because of improper techniques.

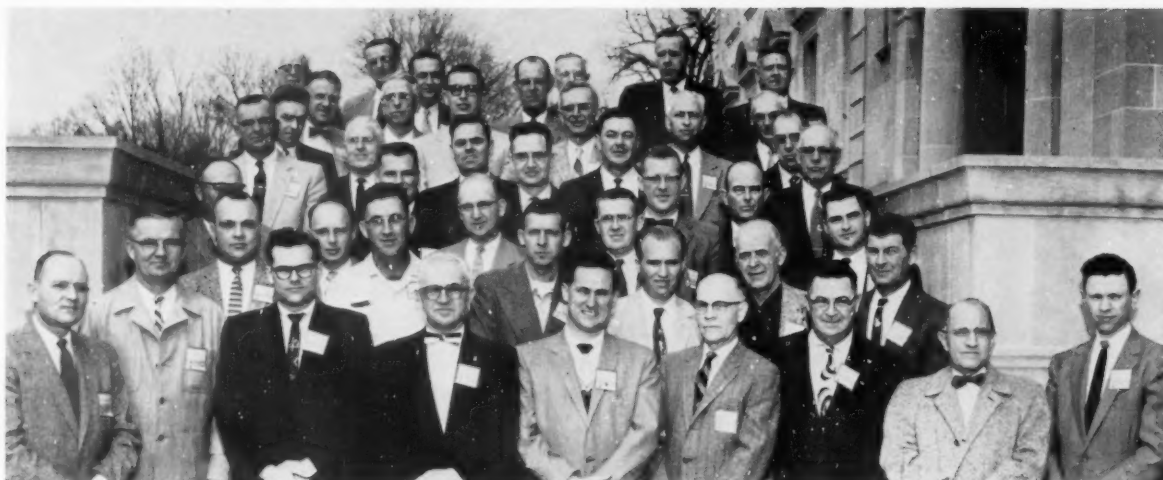
Sanders and Clemmer Head APWA Specification Committees

Chicago, Ill.—Two new specification committees were recently appointed by APWA President Robert L. Anderson. One will revise the Association's standard specification on bituminous pavements, while the other will prepare a new three-part specification on soil stabilization covering the use of calcium chloride, sodium chloride and lime.

Wallace Sanders, Chief Engineer, Louisville, Kentucky, was appointed Chairman of the Specification Committee on Bituminous Pavements. Others named to this Committee were: Thomas H. Coghill, Bexar County Road Engineer, San Antonio, Texas; James J. Sullivan, Superintendent of Streets and Engineering, Springfield, Massachusetts; J. M. Tippee, Director of Public Works, Des Moines, Iowa; Julius Adler, Consulting Engineer, Philadelphia, Pennsylvania; C. A. Keeping, Engineer of Streets, Winnipeg, Canada; John Lambie, County Engineer, Los Angeles, California; M. Osgood, President, Ann Arbor Construction Company, Ann Arbor, Michigan; and Paul J. Jorgensen, City Engineer, St. Petersburg, Florida.

The Association's Specification Committee on Soil Stabilization will be headed by Harold F. Clemmer, Engineer of Materials and Standards, District of Columbia. Other members appointed to serve on this Committee were: William D. Monroe, City Engineer, Jackson, Michigan; Vernon C. Peebles, Chief Engineer, Raleigh, North Carolina;

OFFICERS: Robert Anderson, Winnetka, Ill., President; Sol Ellenson, Newport News, Virginia, Vice President. REGIONAL DIRECTORS: (three year terms) Albert G. Wyler, New Orleans, La.; Wm. D. Hurst, Winnipeg, Manitoba, Canada; Frederick Crane, Buffalo, N. Y.; (two year terms) Jean L. Vincenz, San Diego, Calif.; Leo Flotron, Dayton, Ohio; Roy W. McLeese, Salt Lake City, Utah; (one year terms) K. K. King, Phoenix, Arizona; Charles W. Cooke, Hartford, Conn.; R. V. Moschell, Alcoa, Tennessee. Immediate Past President, Edward P. Decher, Newark, N. J. Donald F. Herrick, Executive Director.



● APWA MEMBERS at the 8th Annual Public Works Conference, sponsored by the Iowa Chapter and Iowa State College.

Reuben S. Rountree, Jr., Director of Public Works, Austin, Texas; Thomas B. Becnel, Chief, Maintenance Division, Department of Streets, New Orleans, Louisiana; Carl C. Fagerlind, Commissioner of Streets, Waterloo, Iowa; E. H. Lindstrom, Assistant City Engineer, Seattle, Washington; and Carl A. Distelhorst, Chief Engineer, Street Construction Division, Milwaukee, Wisconsin.

Iowa State College Holds Eighth Annual Public Works Conference

Ames, Iowa—Nearly 80 delegates attended the Eighth Annual Public Works Conference held at Iowa State College, in Ames, on March 13 and 14, 1957. The Conference was sponsored by the Iowa Chapter of the APWA and the Engineering Extension and Civil Engineering De-

partments of Iowa State College.

Arnold Chantland, City Engineer, Nevada, presided at the opening session, which included introductory remarks by John Lagerstrom, Assistant Dean, Engineering Division, I.S.C., and a panel discussion on "Merit Incentive Pay Plan." Participants were: Jim Hoag, Personnel Manager, Iowa Highway Commission, John Carpenter, City Manager, Ames, and William Besudin, City

"We dig 34-8 ft. holes in 3 hours with our ROPER automatic hole digger"



says M. Z. Thomas, Stow, Ohio

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The light weight, hi-tensile alloy steel construction and smooth crawler mounting of this Cleveland 92 "Baby Digger" enabled Rich & Co., Bradford, Pa. to cut 70,000 feet of trench in stony tough digging without causing damage to the sidewalks and fine old lawns in and around Groton, N. Y. The compact design and quick-and-easy maneuverability of the 92 were other big helps in digging these 4-inch pipe gas mains and laterals for New York State Electric and Gas Co., Ithaca, N. Y. The rugged 92 weighs only 10,000 pounds, is only 4½ feet wide over its crawlers, yet digs 10 to 20 inch trench widths and down to full 5 feet deep—in *all* soils.

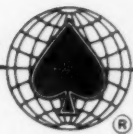
The 10,000 lb. 92 treads lightly on lawn and sidewalks.



Compact 92 can put trench within 20" of side obstructions



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Manager, Hudson, Michigan. Ralph Canty, Superintendent of Public Works, New Hampton, presided at the afternoon session, which included three informative talks. The first, by Ralph E. Patterson, Jr., Associate Professor, I.S.C., was titled "Training of Technical Personnel;" the second, by Robert Brittin, Zone Manager, Motorola Radio Company, Lincoln, Nebraska, was on the "Use of Radio in Municipalities;" and the third was titled "Private Weather Informants Benefits For Cities," by John Murray, Weather Consultant. Presiding at the dinner meeting

was Lloyd Dove, City Engineer of Ames. The guest speaker was Paul A. Rodgers, Director of Public Relations, Ozark Airlines, St. Louis, Missouri. William Packard, Director of Public Works, Ames, was Chairman of the morning session on the second day of the Conference, which included a talk on "Economical City Paving," by Dave Comann, Field Engineer, Portland Cement Association, Des Moines. The morning session also included an interesting panel on "Coordination of Utilities and Their Mutual Problems." George Arrunds, Water

Works Superintendent, Ottumwa; Homer Haskins, Plant Engineer, Northwest Bell Telephone Company, Des Moines; and Del Raymond, General Sales Manager, Iowa Public Service Company, Sioux City, took part in the panel discussion.

Chapter President Ken Cullen, City Engineer, Dubuque, presided at the luncheon, which featured an address by APWA President Robert L. Anderson, Superintendent of Public Works of Winnetka, Illinois. Angus Crawford, City Manager, Iowa Falls, presided at the closing session, which included the presentation of a movie on sewer cleaning and maintenance by Eli N. Eastman, Superintendent, Sewer Construction and Maintenance, Waterloo, and an excellent talk on "Limited Access of Highways To Cities and Towns," by Emil Johns, Right-of-Way Engineer for the Iowa State Highway Commission.

Washington Chapter Committee Issues Construction Standardization Report

Tacoma, Wash.—The Construction Standardization Committee of the Washington State Chapter of the APWA was appointed in May, 1956, by Chapter President William A. Stancer, Pierce County Engineer.

The activation of this committee was the result of a panel presentation at the Chapter's 1956 annual meeting outlining the various construction problems and localized high costs in many areas of the State. This was attributed to the fact that no standardization of common construction items was being practiced. As an example, five different standards for the construction of concrete curb and gutter sections are at present being used within a nine-mile radius. This prevents the use of standard forms for curb construction by contractors within the area. Moreover, there is no definite standard for other nearby communities to follow when the need arises. By standardizing, lower construction costs are probable, and communities without direct engineering service can adopt such standards as accepted engineering designs.

Myron D. Calkins, City Engineer of Tacoma, was named Chairman of the Committee, which was directed to make a study of those construction items which were felt to be particularly applicable to standardization, and further to recommend for adoption the various details connected with such standardization. Other members of the Committee

(Continued on page 230)

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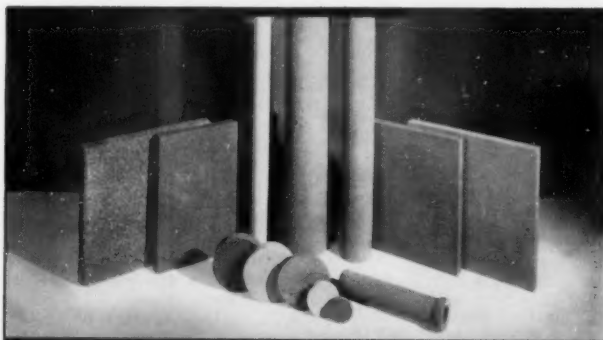
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ALUNDUM* Seamless Porous Tubes

The more efficient filtration system you install, the safer, more pleasant and popular your pool will be. You can be sure of these advantages when you specify diatomite filters equipped with ALUNDUM porous tubes.

Made by a controlled structure process, these seamless tubes assure more uniform filtration and faster, more thorough cleaning by backwashing. And because they're made of tough, corrosion-resistant aluminum oxide, they provide long, trouble-free service. They are a typical Norton Refractory \mathcal{R} — *engineered and prescribed* to give better service and to save money. That's proved by the fact that leading filter manufacturers such as Proportioners, Inc., of Providence, Rhode Island, use ALUNDUM tubes in their filter equipment.

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The Operation of Water Treatment Plants . . .

(Continued from page 134)

be standardized immediately prior to the start of each test. It is preferable to use amber bottles for the chlorine water. Standardization is by titration with N/10 or N/40 sodium thiosulphate, in accordance with *Standard Methods*. Strength of the chlorine water should be such that the volume of the treated sample will not be increased by more than 5 percent. If the ammonia content of the water is known, it may be possible to determine the approximate chlorine application required to produce a free chlorine residual. A rough guide is to multiply the ammonia content by ten. Applications of chlorine should be so arranged as to cover a reasonable range on either side of this figure.

Contact—Allow the sample to stand after addition of chlorine for a period equivalent to that provided by the plant sedimentation basin or clear well, whichever is to be utilized for break-point treatment. During testing, the sample should be kept at the temperature of the water in the plant and away from strong light.

Residual Chlorine—At the end of the desired contact period, de-

termine the residual chlorine in each sample. Procedures for total chlorine and free residual determinations are discussed in the next section.

Tastes and Odors—Taste and odor determinations should be made on all samples at the end of the contact period selected. It is desirable that these values be recorded as Threshold Units though the original standard methods procedure of taste and odor designation may be used where threshold odor equipment is not available.

Residual Chlorine Determinations. Both combined and free residuals

Reprints of this article will soon be available in convenient booklet form for use in training courses and as a handy reference at water treatment plants. Order from Book Dept., PUBLIC WORKS, 200 South Broad St., Ridgewood, New Jersey. Cost is \$1 per copy; 5 for \$4.50; 10 for \$8; further discounts for larger quantities.

or total chlorine may be measured by the orthotolidine method or the iodometric method. If tests for free residual chlorination are being made specifically as discussed in the previous section, the OTA method must be employed. The orthotolidine flash test is of value as a qualitative indication of free chlorine residuals.

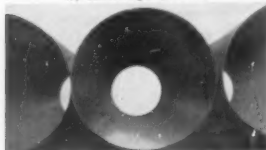
Procedure with Orthotolidine—A standard orthotolidine solution is furnished by makers of chlorinating apparatus and by laboratory and chemical supply houses. A very light yellowish color reaction with this test indicates about 0.1 ppm., and the color deepens with the increase of chlorine. Color standards are necessary in order to read closely the amount of chlorine present. When iron or manganese are present in sufficient quantity to interfere with the test, modifications are necessary in the procedure.

With Ammonia - Chlorine—When both ammonia and chlorine are applied to the water, a longer period is necessary for the color to develop after the orthotolidine has been added. A free chlorine residual will develop maximum color almost instantly. If a combined residual has resulted, the color development should be observed within 5 minutes.

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◀ **Cleaning a Drainage Ditch . . .** the Texas Highway Department puts one of its HD-6G's into action. Other 6G's are used to cut channel, subgrade, load road base, pull compaction rollers and scrapers.

◀ **Loading Red Clay into Trucks** for new roadbeds is a part-time job for the HD-6G owned by District No. 2, Newton County, Georgia. This workhorse is also used to dig utility trenches, lay concrete pipe, clear right-of-way and cut drainage ditches.

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72 net engine hp • 19,600 lb • 1½ yd bucket

Attachments easily interchangeable with standard bucket—rock bucket, light materials bucket, drag bucket, bulldozer and angledozer blades, lift fork, crane hook, trench hoe, rock fork. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.



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With Iron and Manganese Present
—If either of these elements is present, a false color reaction occurs with orthotolidine, thus making the test for residual chlorine unreliable.

Since residual chlorine rarely persists for as much as 24 hours, two samples may be collected each day, one of which is tested at once and the other allowed to stand for 24 hours before testing. The apparent chlorine content of the latter is subtracted from the apparent chlorine content of the former to secure the approximate true residual. The OTA test also indicates the amount

of interfering color from manganese, iron and nitrites.

Iodometric—This is the standard test for total residual chlorine and is adaptable to determining concentrations in high ranges as well as those normally encountered. It involves acidification of the sample with acetic or sulfuric acid to a pH of 3 to 4 and addition of potassium iodide solution, from which iodine will be liberated, the quantity a function of the chlorine present. The liberated iodine is then measured by titration with 0.01N sodium thiosulfate, using starch as an indicator. If the concentration of chlorine is

expected to be 1 mg/l or less one liter of sample should be titrated; if between 1 and 10 mg/l, 500 ml is the appropriate sample; and if above 10 mg/l, the amount is halved for each 10 mg/l. The titration should not require more than 20 ml of sodium thiosulfate.

The Orthotolidine Flash Test (Laur) is an adaptation of the orthotolidine test. Special emphasis is given to the speed of color development when orthotolidine is added to the sample. From a practical viewpoint, free available chlorine reacts instantly with orthotolidine, regardless of the temperature. On the other hand, the reaction with chloramines is relatively slow especially at the lower temperatures. Thus, the reading obtained immediately indicates the amount of free available chlorine present, and color developing thereafter approximates the amount of combined chlorine or chloramines. The test is most sensitive below 60°F; for higher temperatures, the samples should be cooled to or below 60°F prior to the test. Accurate results will depend on the timing of the readings; the first should be made in exactly 5 seconds, and the second exactly 5 minutes after the addition of orthotolidine. Since the 5-second reading shows the amount of free available chlorine, and the 5-minute reading, the amount of total residual, the difference between the two readings will show the chloramine present, consideration being given to the presence of interfering substances. The most accurate range is 0.3 mg/l or less. The higher the combined residual, the more inaccurate the free chlorine residuals become.

The OTA test determines the amounts of free available chlorine and chloramine present and will automatically compensate for interfering colors produced by manganese, iron and nitrites. This test can also be used to determine the exact amount of interfering color. Precision of results depends upon strict adherence to test procedures: (a) the time intervals between addition of reagents; (b) the relative concentration of free available chlorine and of combined available chlorine in the sample; and (c) the temperature of the sample, which should never be above 20°C (68°F). The precision of the test increases with decreasing temperature. Details describing performance of these tests will be found in *Standard Methods*.

Actually three chlorine residual values are determined simultane-



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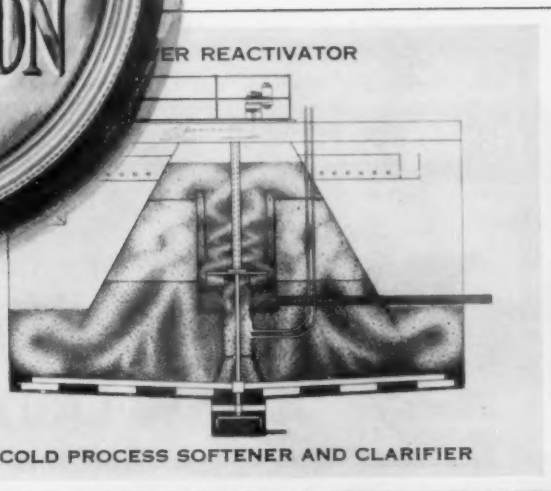
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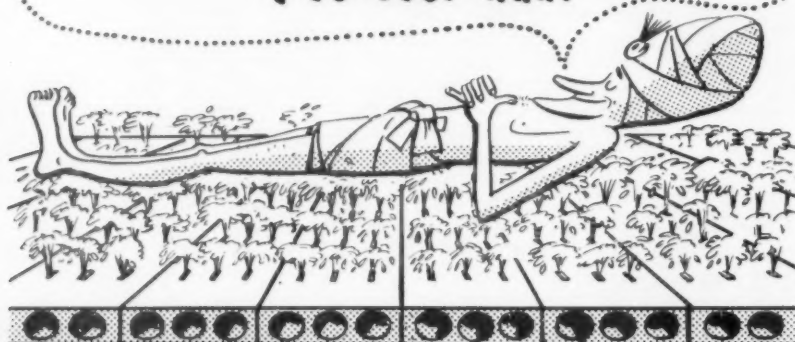


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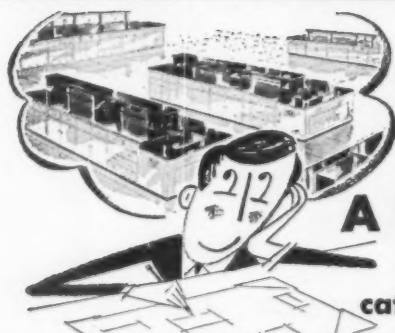


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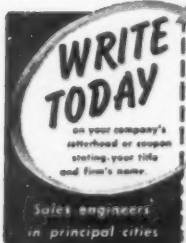


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ously. Three samples are used, labeled A, B and OT. In sample A, the color developed by orthotolidine after the addition of an arsenite reagent is measured and is the free chlorine plus any interfering substances. Sample B is added to a cell containing the arsenite solution added previously. The instantaneous color development with orthotolidine and that appearing after 5 minutes are read as B₁ and B₂. Sample OT is added to a cell containing orthotolidine solution and the 5-minute reading is obtained.

Total residual chlorine = OT - B₂;
free residual chlorine = A - B₁; and
combined residual chlorine = (OT - B₂) - (A - B₁).

Disinfecting Mains and Reservoirs

Water mains should be protected against contamination while they are being installed; dirt and other material should be removed before laying. Before being placed in service, every section of pipe should be flushed out and then chlorinated, using a dose sufficient to give 50 mg/l of residual chlorine with a contact period of at least 12 hours.

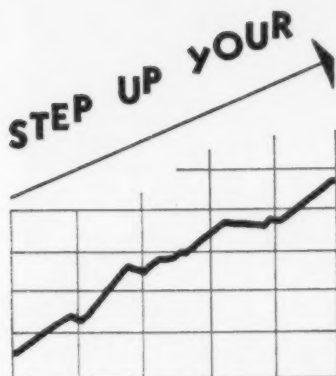
When liquid chlorine is used, a corporation cock is inserted in the old line near the connection to the new line, and a special stuffing box is inserted and connected to a chlorine cylinder with a silver or copper tube. The stuffing box and tube can be obtained from manufacturers of chlorinators; also special chlorinators for this purpose are available and are preferable.

The line is flushed out; after it has drained, water is then turned into it slowly, and chlorine gas from the cylinder is turned into the main. Water pressure should normally be below 30 pounds.

A chlorine solution can be used instead of liquid chlorine, in which case it can be forced into the main with a pump or added to the water entering the main.

When using bleaching powder, 25 percent available chlorine, the following amounts are required for each 100 feet of pipe: 4-inch, 1½ ounces; 6-inch, 3½ ounces; 8-inch, 6 ounces; 10-inch, 10 ounces; 12-inch, 15 ounces; 16-inch, 36 ounces. When using HTH or Perchlolorin, 40 percent as much is sufficient; AWWA Standards suggest 1 pound (70 percent available chlorine) for each 1680 gallons of pipe capacity to be treated.

When the bleach is placed in the pipes as they are laid, the line is filled slowly with the water and allowed to stand for 12 hours; it is



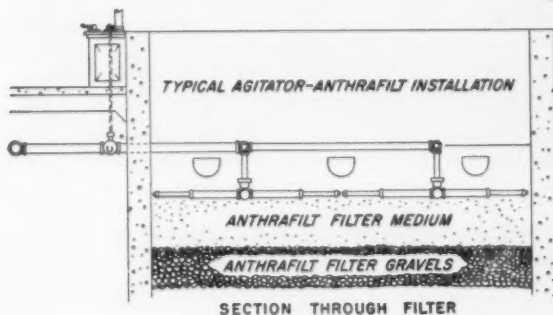
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- 7—Low operating cost
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The Palmer Filter Bed Agitator is covered by U. S. Patents 2309166 and 2309017.



The Palmer Agitator consists of a horizontal bronze arm suspended just above the surface of the Anthrafil or sand. The agitator arm contains jet nozzles through which water is forced at extremely high velocity. The jets are pointed downward to penetrate the filter media before the wash-water is turned on. This penetration breaks up the surface of the filter bed while the agitator revolves slowly, propelled by the velocity of the water through the jets. Thus, the media is in a fluid condition and free from encrusted deposits when the wash water is turned on. When the wash water reaches the level of the agitator arm, the tremendous velocity of the jets causes violent turbulence while the upper strata of the sand or Anthrafil is expanded. The Palmer Agitator remains in action until shortly before stopping the filter wash.

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PALMER

FILTER EQUIPMENT

Company

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then flushed thoroughly. A serious disadvantage of this method is that the end of the line at which water is admitted is not adequately treated, since most of the bleach is washed to the lower end by the inflow of water. The method should not be used if the method previously described is possible.

Orthotolidine tests are made on the water as it comes out of the valve or hydrant at the far end of the line. When a deep yellow color is obtained by the test, allow the line to fill, shut off the chlorine, and the valve admitting water to the new line. Allow to stand for 12 hours, and flush thoroughly. If there is no valve or hydrant at the lower end of the line, a testing plug fitted with a stop-cock can be placed in the end of the pipe line, to permit the discharge of air as the line is filled with water, and also to permit taking samples of water for orthotolidine tests.

Filters, elevated tanks, concrete or steel reservoirs, and other similar structures, should also be treated before being placed in service. Liquid chlorine may be added to the water as these are being filled; $\frac{1}{2}$ to 1 pound of bleaching powder, 25 percent available chlorine, may be used for 1,000 gallons of water. State Boards of Health will furnish detailed directions for procedures for each individual case.

Safety Measures—In addition to the precautions already outlined in regard to the use of chlorine and ammonia, a gas mask should be available in a room not connected to the chlorine or ammonia application or storage rooms. Not all gas masks protect against ammonia. Read carefully the statement on the gas mask canister to be sure that it will protect against both gases. A first aid kit should also be kept readily available.

Safeguarding Water Quality

Merely to produce a safe water by the methods described above is not sufficient: it is necessary also to insure that the water reaching the consumer is safe. Connections to unsafe supplies constitute the principal hazard; but plumbing fixtures subject to back-siphonage, and negative pressures or vacuums in pipe lines also may contribute to the danger.

Adequate ordinances governing cross connections and types of plumbing, plus a comprehensive inspection and educational program will eliminate many of the hazards due to such causes. The State Sanitary engineer will be glad to advise

and to assist in such a program.

Negative pressures in pipes may permit the entrance of contamination through imperfect joints or broken sections of pipe. To prevent such negative pressures the treatment plant should be ample in capacity to meet the peak demands for water; mains and submains should be large enough to supply all sections of the community at times of maximum demand; and elevated tanks and reservoirs should be provided to insure the maintenance of safe pressures throughout the community. Perhaps most important of all is to maintain in the entire distribution system, at all times, a perceptible chlorine residual in the mains.

FLUORIDATION

A development of the last decade is the treatment of water to minimize tooth decay by the addition to water of controlled amounts of chemicals containing fluorides. Since the fluoride ion (F^-) is desired in the water, any of several compounds may be employed. These include sodium fluoride, NaF ; sodium fluosilicate or sodium silicofluoride, Na_2SiF_6 ; ammonium fluosilicate, $(NH_4)_2SiF_6$; hydrofluosilicic acid, H_2SiF_6 ; hydrofluoric acid, HF ; and fluorspar, principally calcium fluoride, CaF_2 . The sodium and ammonium compounds are usually available in powdered or granular form, more or less soluble. The acids are liquid or in solution form, and the fluorspar is crystalline.

Dosages Required. The optimum concentration recommended is about 1 mg/l of fluoride. Since fluorides do not react in water nor are dissipated, it is a safe assumption that the net result of fluoride addition is the sum of the natural fluoride concentration and the added fluoride. The compounds mentioned contain various percentages of fluorine, depending upon their chemical composition and purity. It is necessary to know, therefore, the natural

fluoride concentration of a water and how much of the fluoride chemical must be added to bring the fluoride concentration to 1 mg/l or the desired concentration. Table 1 shows the available fluoride in the more commonly used chemicals.

To illustrate the use of the table in arriving at the required dosage, the following example is presented.

It is desired to increase a natural fluoride concentration of 0.2 mg/l to 1.0 mg/l by adding sodium fluosilicate. The average daily consumption is 10 MG. By consulting the table, we note that 1.4 lbs. of sodium fluosilicate must be used for each 1 MG to increase the fluoride concentration 0.1 mg/l. Therefore, the total dosage would be $1.4 \times 8 \times 10 = 112$ lbs. per day.

Feeding Methods. Sodium fluoride, sodium fluosilicate and ammonium fluosilicate may be fed in the powder form in a volumetric dry feeder or gravimetric feeder of the usual type employed at water plants, except that more precise measurement might be desired. Most feed machine manufacturers have models recommended specially for fluoride addition. Solution feeders may be used, also. This, however requires an auxiliary solution tank or saturator. The hydrofluosilicic acid is supplied in liquid form and is applied by means of a solution feeder. Fluorspar can be added by a means only recently developed. Crushed fluorspar is dissolved in an alum solution and the resulting material can be fed by means of a solution feeder.

Where coagulation or lime-soda softening is employed, the fluorides are added after coagulation and settling, and even after filtration if feasible. In the case of well supplies or closed systems, a solution feeder is employed to inject the fluorides into the discharge, usually of high lift pumps.

Testing for Fluorides. Colorimetric methods are employed involving the use of Nessler tubes and prepared standards or colorimeters available from laboratory supply houses. The latter are generally sufficiently accurate for most con-

Table 1—Available Fluoride in Selected Fluoridation Chemicals

Chemical Name	Purity of Commercial Form	Available Fluoride	Dose Req'd per 0.1 mg/l F—
Sodium Fluoride	90	40.5	2.06
	95	42.8	1.95
	98	44.1	1.89
Sodium Fluosilicate	98.5	59.7	1.40
Hydrofluosilicic Acid	30	23.7	3.52

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trol work and can be safely employed in the average small plant. Since there are chemical interferences possible, it is advisable to have check samples run by the state health department or other laboratory. If the chemical characteristics of the water are not subject to variation, a constant correction can be applied in the local testing.

Safety Precautions. Fluoride-bearing chemicals are not the only poisonous chemicals handled at a

water plant, but since fluorides are accumulative, special care need be observed to protect the operators. Principally, the necessary methods involve good housekeeping; correct storage of well-labeled containers; cleanliness; and dust control. Dust filters are available from most feed machine manufacturers. The use of protective clothing, gloves, respirators, and goggles are advocated for persons handling the chemicals routinely.

ALGAE IDENTIFICATION AND CONTROL

Plant growths of the algae type may create trouble by causing tastes and odors, by giving the water a colored appearance, and by tending to clog filters or other treatment processes. In addition, other microscopic organisms in water may contribute to these troubles or cause some all their own.

The microscopic organisms in water include the algae and fungi, which are plants; and the protozoa, rotifera, crustacea and vermes, which are animals.

The term *plankton* is often used to designate the above organisms. Strictly speaking, the term refers

to organisms that float free in the water, but it has been extended to include those organisms, exclusive of bacteria, that are found in the open waters of lakes and streams.

Algae—There are six commonly recognized classes of algae: Cyanophyceae, or blue green; chlorophyceae, or green; xanthophyceae, or yellow green; diatomaceae, or diatoms, usually brown; the phaeophyceae, or brown; and the rhodophyceae or red. Each of these classes are still further subdivided.

It is necessary that treatment be based on actual knowledge of algae growth conditions. This is best ob-

tained by a microscopical examination to determine the kind and number of organisms in the water. With such knowledge, treatment may begin as needed; but if facilities for this examination are lacking, algae control in the northern part of the United States, should generally start about May 1 and continue till nearly Nov. 1.

Microscopical Examinations for Algae Growths—A sample of about two liters of the water should be taken from a point where the organisms will be as representative as possible. The container should be inserted with the neck downwards about a foot below the surface of the water, then inverted and allowed to fill. For greater depths, special sampling devices are necessary. The sample should be examined within 6 to 8 hours; if this is not possible, it should be preserved by adding 20 ml of the formalin to each liter of water in the sample.

If the sample of water contains a large number of organisms, it can be examined microscopically without concentration. If the number of organisms is small, the sample should be concentrated by filtering or centrifuging. The Sedgwick-Rafter method of concentration is relatively simple.

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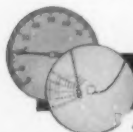
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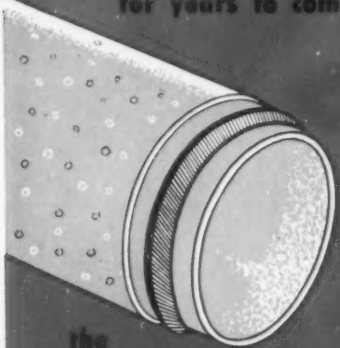
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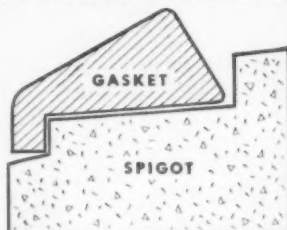
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**Table 2—Copper Sulfate Required for Treatment
of Microorganisms¹**

Organism	Odor	Mg/l	Lbs. per MG
Asterionella	Aromatic, geranium, fishy	0.12-0.20	1.0- 1.7
Synedra	Earthy	0.36-0.50	3.0- 4.2
Tabellaria	Aromatic, geranium, fishy	0.12-0.50	1.0- 4.2
Eudornia	Faintly fishy	10.0	83.2
Hydrodictyon	Very offensive	0.10	0.8
Pandorina	Faintly fishy	10.00	83.0
Volvox	Fishy	0.25	2.1
Anabaena	Moldy, grassy, vile	0.12	1.0
Aphanizomenon	Moldy, grassy, vile	0.12-0.50	1.0- 4.2
Clathrocystis	Sweet, grassy, vile	0.12-0.25	1.0- 2.1
Coelosphaerium	Sweet, grassy	0.20-0.33	1.7- 2.8
Cylindrospermum	Grassy	0.12	1.0
Ceratium	Vile	0.33	2.8
Cryptomonas	Candied violets	0.50	4.2
Dinobryon	Aromatic, violets, fishy	0.18	1.5
Glenodinium	Fishy	0.50	4.2
Mallomonas	Aromatic, violets, fishy	0.50	4.2
Peridinium	Fishy, like clam shells	0.50-2.00	4.2-16.6
Synura	Cucumber, muskmelon, fishy, bitter	0.12-0.25	1.0- 2.1
Uroglena	Fishy, oily, cod liver oil	0.50-0.20	0.4- 1.6
Beggiatoa	Very offensive, decayed	5.00	41.5
Crenothrix	Very offensive, decayed	0.33-0.50	2.8- 4.2
Sphaerotilis natans	Very offensive, decayed	0.40	3.3

The microscope used should be capable of magnification of from 60 to 400. The degree of magnification used depends upon the type of organisms present and whether the organisms are being counted or identified. Methods for microscopical examination of water are covered in detail in *Standard Methods*. The identification of algae types requires considerable experience and at first will require reference to illustrations of the various types. A complete treatment, and a large number of illustrations will be found in "Algae of Importance in Water Supplies," by Palmer and Tarzwell, Public Works, June, 1955. This is available as a reprint.

Copper Sulfate Treatment

Prevention or control of algae is necessary in both storage and distributing reservoirs. Algae growths may be killed by the use of copper sulfate, or chlorine dioxide. Copper sulfate is almost universally used for algae control in large reservoirs, because chlorine and chlorine dioxide are difficult to apply effectively in such places. In table 2 the more troublesome algae types are listed, with their odor characteristics, and the amount of copper sulfate required for treatment.

An adequate dosage of copper sulfate should be applied as insufficient dosages are ineffective. A concentration sufficiently high to be injurious to health would have such a disagreeable taste that it would be practically impossible to drink it. However, the dosage necessary for control of algae may be sufficient to

kill fish. Therefore, if fish are present in the water to be treated, it is advisable to consult Table 3 which shows the resistance of various species of fish.

Application of Copper Sulfate. Four forms of copper sulfate are available for use: Lump crystals, commonly known as bluestone; granular; snow or fine granular; and powder. Most

**Table 3—Dosage of Copper
Sulfate Likely to Kill Fish²**

Fish	mg/l	lbs./MG
Trout	0.14	1.2
Carp	0.33	2.8
Suckers	0.33	2.8
Catfish	0.40	3.5
Pickrel	0.40	3.5
Gold Fish	0.50	4.2
Perch	0.67	5.5
Sunfish	1.36	11.1
Black Bass	2.00	16.6

algae and other microorganisms which cause tastes and odors are found in the upper 10 feet of the water where sunlight is strongest. Therefore, better results frequently may be secured by using powdered copper sulfate to destroy organisms near the surface and the "snow" or granular material for deeper-lying

1. Hale, Frank E., "The Use of Copper Sulphate in Control of Microscopic Organisms," Nichols Copper Co., New York.

2. Moore, G. T., and Kellerman, K. F. Bul. No. 76. Bur. Plant Indus. U. S. Dept. of Agri. (1905).



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organisms, because the larger granules sink into the water for an appreciable distance before dissolving.

The most common procedure in applying copper sulfate is to place the crystals in bags which are then dragged around behind a boat, generally following a criss-cross pattern. This is not always fully satisfactory. Syracuse, N.Y., has devised an apparatus by which water is pumped from the lake into a dissolving drum into which copper sulfate crystals are fed. The water dissolves the crystals and the solution is then sprayed onto the water. A width of 40 to 50 feet is treated. Newburgh, N.Y. has used a blower to scatter the dry crystals from the rear of a

boat. The "snow" grade is used for light applications, the granular grade for heavy dosages; and combinations as needed.

Liberty, N.Y., has employed a duster for summer application, but has utilized another variety of copper sulfate—the monohydrate, which is especially adapted to blowers. For winter application through the ice, an outboard motor was lowered into the water, a bag of crystals placed behind the propeller, and the whole rotated so as to cover the entire circle around the hole. Tests indicated that effective dosages could be obtained by holes cut 1000 feet apart. An extension must be placed on the propeller shaft to allow lowering to the desired depth.

particularly evident when reservoirs are low, and contain swampy or stagnant areas.

Aquatic actinomycetes, also microscopic organisms, appear to elaborate a number of organic compounds, giving rise to production of tastes and odors in certain surface water supplies.

Severe and troublesome taste and odor conditions may be due to industrial wastes from coke plants, chemical plants, canneries, tanneries, oil refineries, and dairies.

Determination of odor may be made with the water either hot or cold—the former giving the more positive results. The intensity and quality or kind of odor is, of course, largely a matter of personal opinion, but trained "smellers" will often agree quite closely.

Cold odor is determined by filling a bottle or flask (capacity about 300 to 500 ml) half or two-thirds full, with water at room temperature (20°C), shaking violently, removing the stopper and smelling.

Hot odor is determined by heating about 200 ml of water in a 500 ml flask, the neck being covered with a watch glass, to 65°C, shaking, removing the cover and smelling.

The "Threshold Odor" test is commonly used in determining intensity

TASTE AND ODOR CONTROL

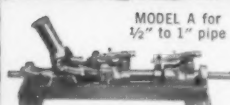
Tastes and odors do not cause disease and rarely indicate dangerous contamination. But when they render a supply unpalatable, the consumer is likely to turn to other supplies, often less safe. To protect the health of the community by furnishing a safe and a palatable water at all times is the duty of the water official. It is also good business.

The most common sources of tastes and odors in water supplies are plant growths of the algae type. Some of these organisms exude oils or decomposition products which impart a disagreeable taste to the water, especially in combination with chlorine. Decaying vegetation, as leaves, grass and moss, is often a contributing cause. This cause is

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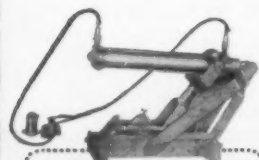
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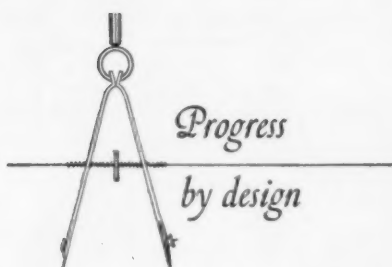
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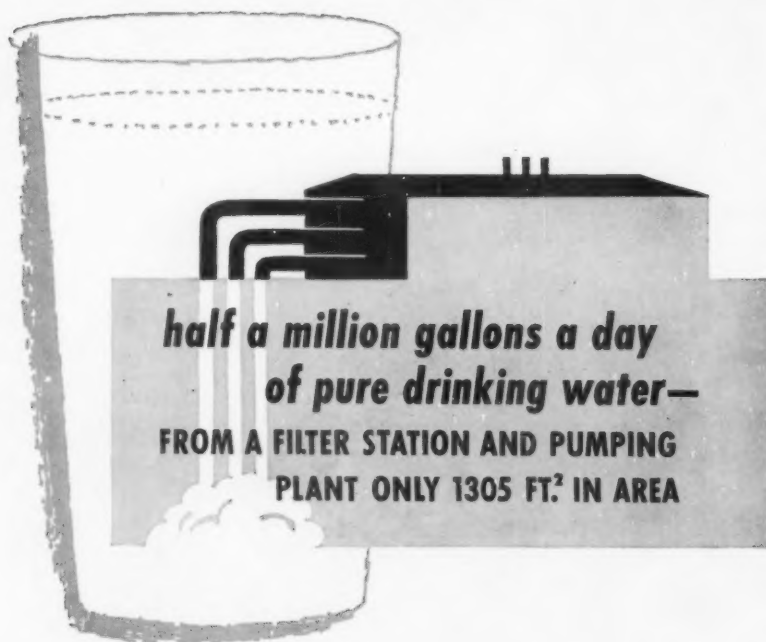


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of odor. It involves progressive dilution of a sample with odor-free water and smelling each dilution under controlled temperature conditions until the odor is barely discernible. The procedure is given in detail in *Standard Methods*. Good use can be made of the Threshold Odor test if it is done routinely by the same person. Changes in odor intensity or characteristics may be detected at an early stage, permitting corrective treatment before consumer complaints can commence.

Methods of Control

The prevention of tastes and odors in the water may be accomplished by preventing the formation or growth of substances that may cause taste, as in the case of algae; by preventing the entrance of industrial wastes into the supply; by neutralizing or destroying the taste and odor-producing substances; or by removing them. Local conditions will usually determine which of these methods or combinations of them will be most effective and economical.

Preventive Measures in Raw Water—Every measure possible should be taken to eliminate at the source all conditions tending to cause tastes and odors. An early step should be a complete and thorough survey of the entire watershed to determine the points where pollution may originate.

Aeration. By exposing a large surface area of the water to air, aeration liberates such gases as hydrogen sulfide and carbon dioxide from the water and permits the oxygen in the air to come into more intimate contact with the finely divided water particles, thus increasing the dissolved oxygen content of the water.

The general types of aerators in use include: (1) The cascade type, where the water is allowed to flow over successive sets of weirs. (2) The diffusion method, which consists of blowing air under a slight pressure through porous plates. (3) The spray method, in which the water is discharged under pressure through nozzles so that the water is forced into the air in a fine spray. (4) The surface contact type, which consists of coke-filled trays through which the water is passed.

Aeration affects only a few of the taste-producing elements. It should be used only after analyses and investigations of the water have shown clearly that aeration will be effective under the conditions that actually exist.

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or granular form. In industrial and a few municipal plants, the water is passed through a bed of granular carbon. In the majority of municipal plants, the powdered form is utilized, the carbon being applied by means of dry feed machines, solution feed machines or mixed with other chemicals. In dry feeding, equipment specifically designed for this material should be used, since activated carbons are much lighter and finer than other chemicals commonly employed in water treatment. In the larger plants, carbon may be purchased in carload lots, and the cars unloaded into an underground tank

where the carbon can be placed in suspension as a slurry. Feeding to water in this form eliminates much of the dust problem associated with activated carbon use.

Points of Application — Where filter plants are a part of the purification process, activated carbon is applied at any point prior to the filters. It may be applied as slurry directly to the water on top of the filters; to the filter influent; part way through the coagulation basin; at the entrance to the coagulation basin; in the mixing basins; or to the raw water. In general the points of application are divided into two

general classifications, namely, prior to coagulation, and following coagulation.

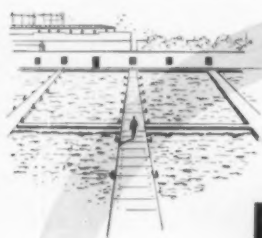
If applied after coagulation the activated carbon will have the least work to do, since there is usually some elimination of tastes and odors during the sedimentation process. This point of application is recommended: (1) where tastes and odors are of short duration; (2) where tastes and odors appear suddenly and have not been noted until they have penetrated fairly well through the plant; (3) where tastes and odors are very mild.

Application prior to coagulation insures a longer contact time for the carbon to do its work. This point of application appears to be most suitable for the following: (1) where tastes and odors occur continually or frequently; (2) where the organic content of the water is relatively high and may cause tastes and odors due to decomposition within the plant itself; (3) where tastes and odors are of a severe nature, requiring heavy dosages of activated carbon. A split treatment may be preferable for serious tastes.

Dosage of Activated Carbon—The required dosages of activated carbon have varied from as low as 1 lb. per million gallons to as high as 1000 or more lbs. per million gallons. However, calculations based on a survey made some years ago by PUBLIC WORKS indicated that the average dosage was approximately 16 lbs. per million gallons.

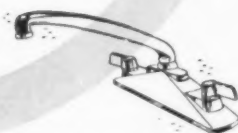
Chlorine. Many types of taste and odor producing substances are subject to oxidation by chlorine, particularly in the free available form. Pre-chlorination is frequently practiced as a successful measure, permitting an extended contact time for complete oxidation and preventing growth of algae and development of other odor-producing microorganisms within the treatment units and storage structures.

Chlorine Dioxide. By feeding a solution of sodium chlorite into the solution discharge of a chlorinator, a compound known as chlorine dioxide, (ClO_2) is formed. This must be prepared at the point of use because of its instability. It, like free chlorine, is a powerful oxidizing agent and has been used to advantage in the destruction of algae and in the oxidation of taste and odor producing compounds. The ratio of chlorine to sodium chlorite is theoretically 1 to 3.1, but in actual practice, it is between 1 to 2 and 1 to 1. Dosages usually employed are less than chlorine alone, around 0.2 to 0.3 mg/l.



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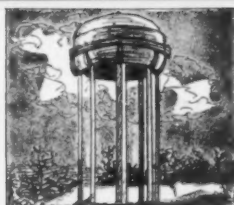
ry agitators, and twelve sets of Leopold glazed tile filter bottoms.

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Automation By Means of Valves

The types of automatic valves are altitude or float valves, pressure-reducing valves, back-pressure valves, relief valves, and pump control valves. Each of these has essentially a single function. Any number of these functions may be incorporated in one valve for the purpose of satisfying a set of hydraulic conditions. This form of automation is called the combination valve. For example, a control system can be established to permit filling and discharge from an elevated tank as well as maintain pressure in a distribution system. This would consist of an altitude valve, two back-pressure valves, two swing check valves, and a booster pump; four pieces of equipment are used to perform the work of six and do it automatically through proper hydraulic and electrical linkage. Automation assists in increasing the overall efficiency of a water system by reducing costs of installation, operation, and maintenance. Reduction in the weights and sizes of pipe, fittings, and valves can result, because equipment can be protected against wide fluctuations in pressure and surges. Another advantage is the conservation of water waste incident to high, unbalanced system pressure.

"Automation and the Automatic Valve." By William F. End, Jr., Ross Valve Mfg. Co., Troy, N. Y. *Jour., A.W.W. Ass'n*, March.

Problems Created by Synthetic Detergents

There are three groups of synthetic detergents of significance in water and sewage treatment: the anionic, the cationic, and the non-ionic. They tend to lower surface tension in water and are said to be "surface active." Builder compounds, intended to enhance surface-active properties, comprise 60 percent of the weight of syndets, and contain various phosphates. Indications are that syndets tend to resist oxygen diffusion into a liq-

uid, limiting biological oxygen utilization. Problems of sewage treatment include excessive frothing on aeration tanks, increased BOD of settled sewage, increased suspended solids, interference with the BOD test, increased BOD in secondary treatment unit effluents and bacteriostatic and bactericidal effects among others. Effects on water treatment include raw water foaming, requirements of higher coagulant dosages, interference with iron and manganese removal, tastes and odors, and foaming produced during washing of cation-exchange softeners. With increasing use of syndets, the impact of these manifestations will become more severe. Additional studies are needed to evaluate the problems and to determine alternative treatment or other control methods.

"Synthetic Detergents in Water and Sewage." By O. John Schmidt. Black and Veatch, Consulting Engineers, Kansas City. *PUBLIC WORKS*, April.

Construction Methods for High Capacity Wells

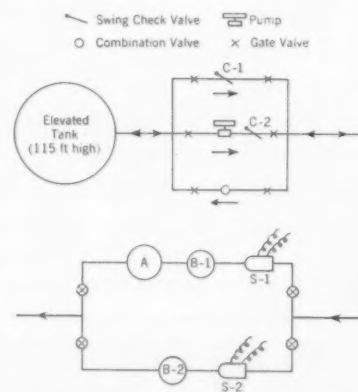
One of the newest wells at Champaign-Urbana has a depth of 313 ft. and a capacity of more than

3000 gpm. As a result of exploration studies in 1946, the size of screen slots and the grade of gravel pack was determined prior to drilling of the permanent well. The Thorpe Well Co. of Des Moines in completing the permanent installation used a reverse hydraulic rotary drilling method which consists of using a high volume of water which flows from a supply pit into the well outside the drill stem. The water and drill cuttings are returned to the surface by suction through the drill stem. With the well full of water, the pressure prevents caving during drilling. An auxiliary well was constructed to supply water for drilling. The permanent well was started 56 ins. in diameter to set the surface drilling crib at a depth of 20 ft. For the next 200 ft., the diameter was 42 ins., at 220 ft., the 36-in. outer casing was set and grouted to a depth of 114 ft. The annular space between the 10 ft. and 114-ft. depths was backfilled with sand, and the top 10 ft. with cement grout. A total of 75 ft. of 24-in. screen was used, with $\frac{3}{4}$ -in. slots. A gravel pack was used in the annulus outside the screen and between the two casings to a depth from the surface of 50 ft. The cost was \$21,500.

"Reverse Rotary Well Construction." By Robert T. Sasman, Illinois State Water Survey. *PUBLIC WORKS*, April.

Underwater Filter Plant

The new South County Purification Plant of the St. Louis County Water Co. was designed to handle 15 mgd, primarily as a standby and summer operation unit. With the Meramec River as a source, a typical flash flood stream, turbidities vary from 50 to 1500 ppm, but are normally less than 100 ppm. The processes employed in the plant consist of two stages of break point chlorination, chlorination and ammoniation of filtered water, lime softening, coagulation and filtration and calcium carbonate stabilization. Unusual features of the plant are



● TOP: Diagram of typical installation employing combination valve. Below: Control used for the combination valve.

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an unattended intake station and remote operated submersible motors, pumps and valves; a single earth embankment purification basin containing a suspended solids contact softener and stabilizer, flocculators, clarifiers and submerged filters; direct connection of the filters with service pumps, resulting in elimination of a pipe gallery, rate of flow controllers, a number of valves and the clear well; a pitot tube for controlling wash water rate of flow; and waste water disposal ponds. The suspended solids contact softener is operated without removing slurry to maintain a defi-

nite sludge blanket level; retention time is 60 minutes. A 60-minute flocculation period is provided; horizontal-axis paddles are operated through universal joints to eliminate the necessity for a dry well for the drive mechanism. The filters, while of the rapid sand type, do not have wash water troughs; the wash water is merely permitted to rise to the top of the basin, without special means for disposal. A sewer valve at the effluent end of the basin is available when needed.

"A Filtration Plant of Novel Design" By H. O. Hartung, Supt. of Production, St. Louis County Water

Co. Water and Sewage Works, March.

Seasonal Water Treatment Plant

The problem of seasonal demand in Phoenix, Arizona, was solved in 1954 by the construction of a 30-mgd water treatment plant that for the present, at least, will be operated only during the summer months. This leaves the regular operating force available for maintenance and repair work the remainder of the year. The plant taps the Arizona Canal, an artery of the Salt River Valley Water Users' Association, at a point 10 miles from Phoenix. A presedimentation basin is used, which at times may remove as much as 50 percent of the turbidity. The remainder of the plant uses flash mixing for 30 seconds, flocculation for 48 minutes, and final sedimentation for 3 hours. Coagulation is accomplished with lime and alum. Prechlorination is practiced for disinfection and taste and odor control, and post chlorination dosages are added after filtration. When the water is muddy, activated carbon is used. The filters are uncovered, but the control equipment is housed. Central controls are located in the chemical building, which include a chlorine residual recorder. A laboratory bench was installed in the chemical building provided with taps that sample all parts of the plant. Filtered water storage amounts to 20 mg, and a 66-in. line connects this reservoir with the distribution system at a point which helps equalize system pressures.

"Phoenix Builds 'Summertime' Filter Plant to Meet Acute Water Demands." By Alice L. Mathis, Chemist, Water Filtration Plants, Phoenix. *Water Works Engineering*, March.

Forecasting Residential Water Demands

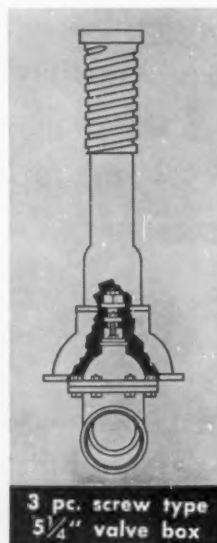
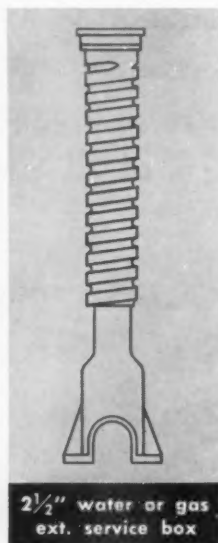
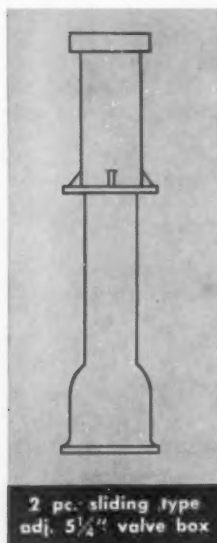
Simultaneous use of domestic water-consuming devices has resulted in increased peak consumption in the last 10 years, and the trend toward suburban living will cause further increases. The estimated rate of per capita increase is expected to lag behind the rate of growth in population served in the next ten years. Based on information from 70 communities in eleven Middle Atlantic States, a relationship was found to exist between the total populations of the area served and the percentage ratio of the maximum to average day's consumption of record in the past ten



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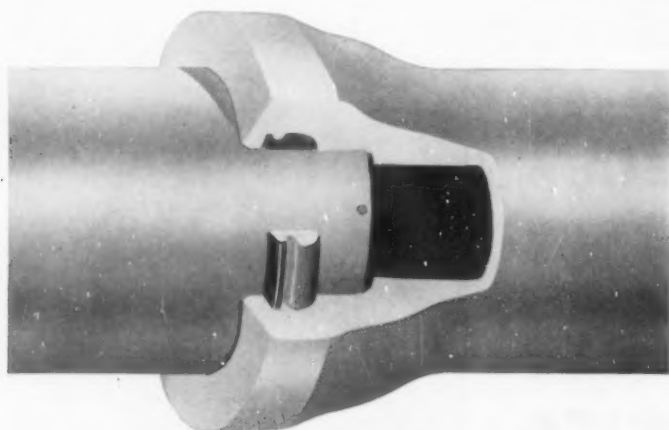
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years. Reduced to formulation, this relationship, by three standard errors of estimate, is subject to a percentage ratio variation of plus or minus 7.0. It was found that a relation also existed between the size of the city and the rate at which the percentage ratio of maximum to average day's consumption is increasing. Given an estimated population, the data from the two relationships may be applied to estimate the percentage ratio of peak day to average day's consumption. To meet the effect of rapid growth in population served, systems must be reinforced in all

stages. For new systems, radically new design concepts must be considered. Growth and water use characteristics of all communities must be carefully reviewed annually and trends must be noted in order that the systems can keep abreast of demands. Annual forecast of the loads as is now done in the power industry appears equally applicable to the water works industry.

"Forecasting Residential Requirements." By Jerome B. Wolff, Deputy Chief, Bureau of Engineering, Baltimore County Dept. of Public Works. *Jour., A.W.W. Ass'n.*, March.



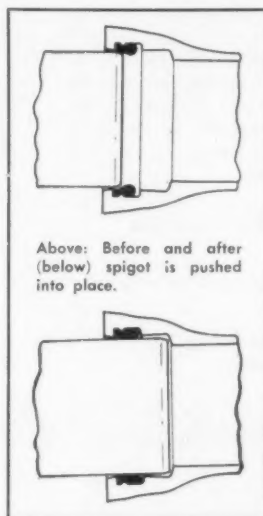
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Newer Concepts of Flocculation

Flocculation has become a separate part of water treatment, frequently employing special agents such as acid-treated sodium silicate and, more recently, the organic polyelectrolytes to build an efficient floc. The trend toward solids contact reactors for sediment removal takes advantage of floc-forming possibilities while permitting a relatively high loading. The rate of flocculation is directly dependent on the velocity gradient in the flocculating chamber—the rate of change of velocity per unit distance. The flocculation accomplished in a given basin will be proportional to the product of the velocity gradient (G) and time (T). Experience has indicated that this product (GT) should be between 10,000 and 100,000. Values of G in most mechanical flocculating chambers are in the range of 10 to 15 fps per ft. The use of jar tests readily determines the isoelectric point (where most rapid floc formation and most complete removal takes place). The condition of the filter effluent serves as a good guide to the operator. If it is turbid, caused by colloids present, the coagulant dose should be corrected. If the filtered water contains flocculated turbidity, a flocculating aid should help, with slower flocculating speed. With short filter runs, the use of clays, bentonite, lime-and-iron treatment, or pulverized limestone may aid in reducing the filter load. Design knowledge is available for correcting almost any clarification problem.

"Flocculation and Flocculation Aids." By Herbert E. Hudson, Jr., Hazen and Sawyer, Engineers, Detroit. *Jour., A. W. W. Assn.*, March.

Microwave Telemetering For Water Plant

A feature of the new water plant at Warren, Ohio, is a system of telemetering by a microwave system. The system is used to convey water level data in storage reservoirs in four parts of the city to the water plant at Mosquito Lake and facilitates control of pumping equipment to meet consumption demands with a minimum of delay. Transducers at the storage reservoirs convert water level data to electrical impulses, fed by direct wire to the service building in the city, where they activate telemetering transmitters. The unit at the service building consists of an RCA transmitter, receiver, power supply



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and auxiliary equipment. The power output is two watts and the frequency range is 890 to 960 megacycles. The equipment at the water plant at Mosquito Lake consists of tone receivers which actuate telemeter receivers to record continuous readings of water level information. In a microwave system, narrow radio beams are used instead of poles and wire lines to carry communications between points. Towers, spaced an average distance of 30 miles apart, relay the beams in a straight line for any distance. The beams provide all-weather communication media, un-

affected by snow or ice, high winds or falling trees.

"Water Levels Telemetered to Control Point on Radio Microwave System." By J. K. Young, Chief Radio Engineer, Warren, Ohio and S. Lapenson, Radio Corporation of America. *Water Works Engineering*, March.

Largest City Using Groundwater Sources

Jacksonville, Florida, uses 48 wells ranging in depths of 1000 ft. to 1500 ft., with a total capacity of 100 mgd. The artesian water formations were first tapped in 1884,

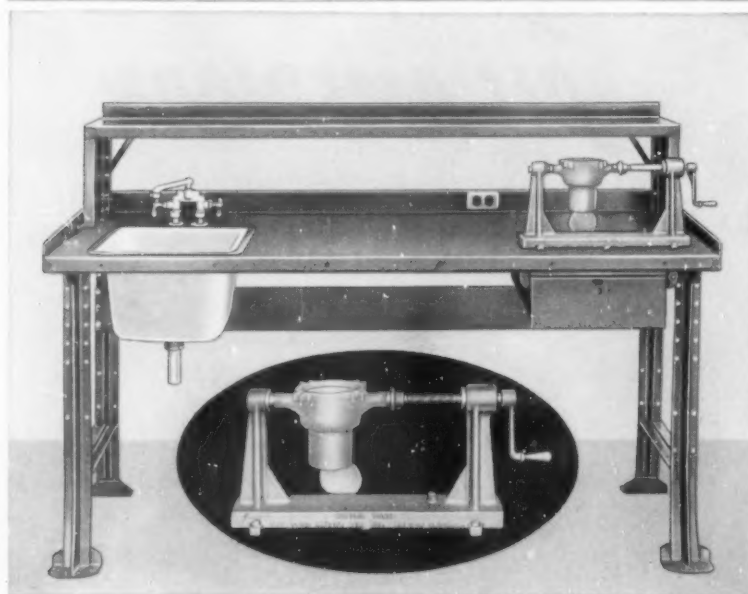
when 4-in. and 6-in. wells were found to flow at 260,000 gpd and 940,000 gpd respectively. The groundwater source is in the Ocala and Eocene limestone formations which outcrop near the central part of the state at an elevation of 150 ft. above sea level. The formations dip toward the Atlantic Ocean and Gulf of Mexico. The draft rate for each well is usually determined by its free flow capacity, and installed pump capacity is not allowed to exceed natural artesian flow. This provides a margin of safety against decreasing yield due to aging of the well and attendant "lining" of the pores of contributing strata. The life of a well is about 20 years, and it is considered expedient to drill another rather than rehabilitate an existing well. A cone of depression has formed around Jacksonville as a result of the heavy drafts, and state laws and city regulations control tapping the aquifers by individuals and firms. Because the water contains hydrogen sulfide, aeration is employed with cone-type nozzle spray aerators. Chlorination is applied to effect a residual in the distribution system of 0.1 to 0.2 ppm.

"Artesian Water—from a Source Five Times Greater than the Great Lakes." By C. H. Helwick and F. A. Schosser, Water Dept., Jacksonville, Fla. *Water Works Engineering*, March.

Vertical Turbines for Distribution Service

Vertical turbine pumps, originally developed for deep well service, are finding favor in other applications. Advantages over horizontal split case volute types are savings in space, better head-discharge characteristics, ability to locate driving mechanisms above flood levels, ability to provide a positive suction at all times, and quieter operation. Disadvantages include higher initial cost, maintenance difficulty, more sensitive suction conditions, and the necessity for carrying weight of rotating parts by a single bearing. At Lincoln, Nebraska, vertical turbine pumps are used to transfer water from receiving reservoirs to storage reservoirs and pumping directly to the distribution system. At Topeka, Kansas, they have been installed to replace an old steam and electric high service station that was subject to flooding. In Shreveport, La., vertical units were used to increase station capacity at minimum cost by using vertical weatherproof motors and no superstructure housing.

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New Roles". By H. H. Benjes, Black and Veatch, Consulting Engineers, Kansas City, AMERICAN CITY, March.

Erdlator Performance Studies Favorable

The excellent behavior of pulverized limestone led to the development of a suspended solids contact clarifier by the Engineering Research and Development Laboratories, Corps of Engineers. Named the "Erdlator," the clarifier is of the up-flow variety, utilizing an external sludge concentrator through

which a continuous flow is maintained to control the slurry level. Principal departures from the conventional design of up-flow clarifiers are the rapid mix in the central compartment, involving peripheral speeds of 10 to 25 fps; the use of a dense sludge blanket, 35 to 65 percent by volume after 5 minutes' settling; and the horizontal rotation of the water and sludge in both mixing and upflow zones. In addition, contact periods are reduced 4 to 5 minutes in the mixing and clarification zones. Efficient turbidity removal with raw water concentrations as high as 2,000 units.

Satisfactory results were also achieved with bacteria and cyst forms of *Endamoeba histolytica*. Color removal to 7 ppm from a raw water figure of 100 ppm was found. The majority of the studies involved using ferric chloride as a coagulant, but filter alum may also be applied. The performance characteristics have been sufficiently encouraging to warrant recommendation of it as the basic surface water treatment unit in combination with diatomite or sand filters for field use by the Corps of Engineers.

"Suspended Solids Contact Clarifier." By H. N. Lowe, Jr. and Richard P. Schmitt, Corps of Engineers, U. S. Army, Fort Belvoir, Va. Water and Sewage Works, March.

Other Articles

"New Reservoirs Aid Industrial Expansion." By A. R. MacPherson. Public Works, April.

"Western Slope Water Development for Denver." By E. L. Mosley, Denver Board of Water Commissioners. Jour., A. W. W. Ass'n, March.

"Peak Demand Storage." By S. W. Freese, Freese and Nichols, Ft. Worth. Jour., A. W. W. Ass'n, March.

"Effects of Sprinkling Restrictions." By G. D. Heggie, Dept. of Water Supply, Detroit. Jour., A. W. W. Ass'n, March.

"Water Supply from Upland Storage." By L. G. Williams, Jones, Henry and Williams, Toledo, Ohio. Jour., A. W. W. Ass'n, March.

"Ground Water in the South Carolina Coastal Plain." By G. E. Siple, U. S. G. S., Columbia, S. C. Jour., A. W. W. Ass'n, March.

"Submerged Aquatic Plants in a Primary Settling Reservoir." By W. B. Cooke, W. M. Ingram, and A. F. Bartsh of the R. A. Taft Sanitary Engineering Center, and J. D. Enright, Supervisor of Water Purification, Cincinnati. Jour., A. W. W. Ass'n, March.

"Value of Calcining Sludge." By Fred Krause, Board of Water and Electric Light Commissioners, Lansing, Mich. Jour., A. W. W. Ass'n, March.

"Elements in Development of Water Supply Sources." By James W. Myers, Jr., Vice President and Chief Engineer, Philadelphia Suburban Water Co., Bryn Mawr, Pa. Water and Sewage Works, March.

"How to Determine When Water Meters Need Repair and Replacement." By R. V. Ford, Ford Meter Box Co., Wabash, Ind. Water and Sewage Works, March.

"pH Control Cuts Chemical Cost, Doubles Capacity, Ends Corrosion." By G. C. Roberts, Macon, Ga., Water Works, Water Works Engrg., March.

"Membrane Filtration Technique for the Bacteriological Examination of Water." By Dr. E. W. Taylor, Director of Water Examination, Metropolitan Water Board, London. Water and Water Engineering, February.

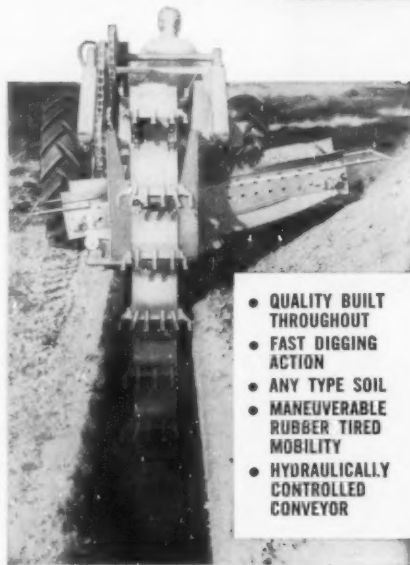
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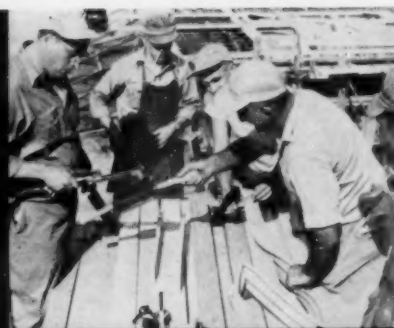
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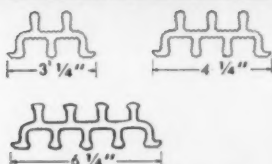
Vertical Joint ready to receive second pour of concrete.

Indented pour. Normal agitation fills corrugated ribs.

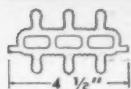
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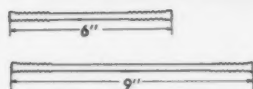
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RURAL POND CONSTRUCTION AND MAINTENANCE

DURING RECENT years, pond building on a large scale has been underway in North Carolina. This is largely due to promotional efforts on the part of governmental agricultural agencies.

In order to prevent the creation of the type of ponds which might invite malaria mosquito breeding (ponds containing constant water level, drift, flottage, or vegetation), a regulation was adopted, requiring the prospective pond-builder to secure a permit from the N. C. State Board of Health. This law concerns any body of water formed by the construction or excavation of a basin or the obstruction of a stream flow in such a manner as to cause the collection of a body of water which would not have formed under natural conditions. Ponds covering less than $\frac{1}{4}$ of an acre are not included in these regulations.

Before a person can obtain a permit to impound water, he must submit an application to his local health department on a form provided for that purpose. This application provides for a description of the pond and includes an agreement for complying with the regulations. The local health department, upon the receipt of the application, inspects the site of the proposed pond. If the site is found to be satisfactory, the applicant is given a Construction Permit which entitles him to build a pond but does not authorize its impoundment. After construction is completed, a representative of the local health department makes another inspection. If the construction is found to conform with requirements, a written recommendation is sent to the State Board of Health to issue an Impounding Permit. Upon the receipt of such a recommendation from the local health department, the North Carolina State Board of Health issues the Impounding Permit. This permit can be revoked in the future if the pond is not satisfactorily maintained.

In 1954, 1147 applications were received and 781 Impounding Permits granted. Some ponds for which applications were made will never be built; some have not been completed; others were not finished in accordance with the requirements. As of the first of 1955 there were 7,371 ponds on record.

Unless judgment be exercised in the selection of the site, as well as

the design and construction of the pond, satisfactory maintenance can become a very expensive problem. The topography of the site should be such that, when the water is impounded, very little or no shallow water of less than 2 feet in depth lies within the area.

In the area to be occupied by the impounded water all trees, undergrowth, logs, stumps, and other objects, which if not removed would float or collect flottage on the surface of the impounded water, and all such material that is lying on the ground which would probably cause the collection of flottage, should be removed, burned, or otherwise satisfactorily disposed of. All trees and other growth which would pierce the water surface at minimum low water level should

be cut down or cut off at least one foot below such water surface to prevent the collection of drift or flottage.

A bottom drain or other means must be provided which will permit the removal of the water and flashboards or other means provided so that the fluctuation of the water level can be controlled at any season of the year.

Pond Maintenance

On small ponds which have been properly planned and constructed, satisfactory maintenance can usually be accomplished by keeping the shoreline free of drifts, flottage, and marginal vegetation. A "clean" pond, as mentioned previously, practically eliminates the malaria mosquito-breeding problem. A special effort should be made to prevent the introduction of aquatic plants, such as bulrushes, cattails,

Clustered Lights Illuminate Shopping Center



EIGHT CLUSTERS of lights mounted "wagon-wheel" fashion atop 60-foot steel standards floodlight the parking area, with space for 1,000 cars, at the Summer Avenue Shopping Center in Memphis. Built at a cost of \$2.5 million, the center houses sixteen stores under one 800-foot long steel roof. The parking area runs the entire length of the store unit. Wide approaches provide easy access to parking spaces.

Each of the eight groups of lights is mounted 60 feet above the ground at the top of a Kerrigan "Weld-forged" pole made of high strength, low alloy steel. The octagon shaped,

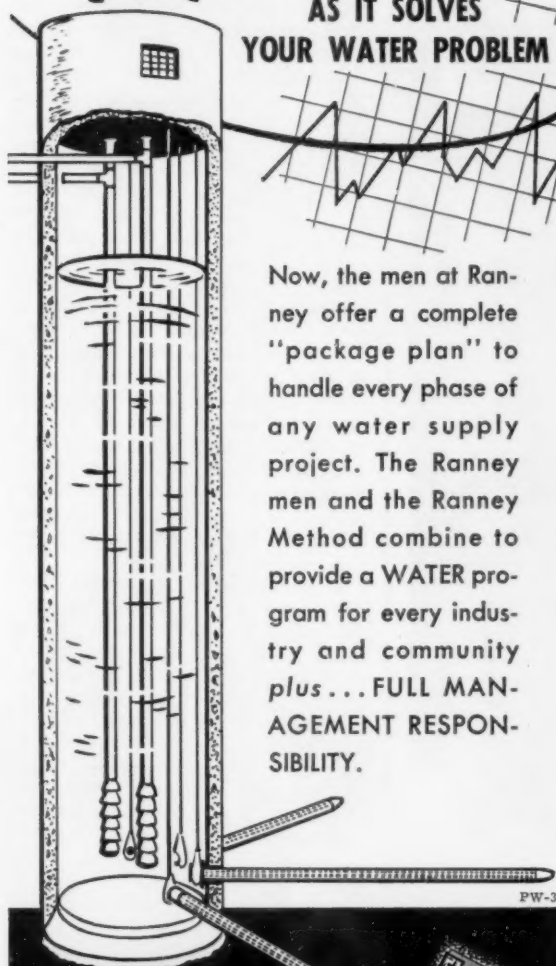
continuous tapered poles were fabricated in two sections for telescopic field construction. Ten luminaires are grouped in a wagon wheel arrangement for mounting on six of the light standards; six luminaires are mounted on each of the other two poles. The floodlight mounting arrangement is equipped with the Thompson disconnect system which allows the luminaires to be lowered to the ground for servicing. S & W Electric Company and Allen Brothers Construction Company (contractors for the center) made the installation. William B. Thompson was the consulting engineer for the job.

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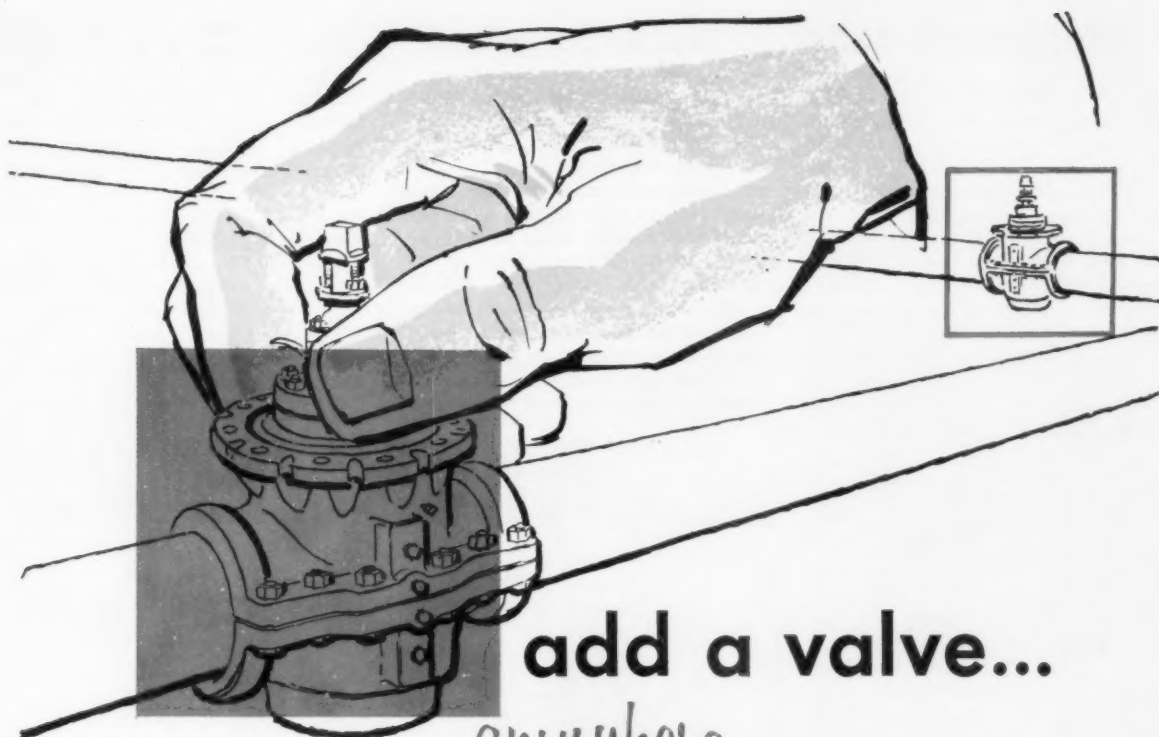


and parrot feather. Periodic inspections should be made around the edges of the pond and if aquatic vegetation is found, it should be removed at once to prevent spreading. A few bulrushes or cattails can be pulled up and removed from the pond with very little trouble. If they become established on a large scale, their removal will constitute a difficult and expensive undertaking.

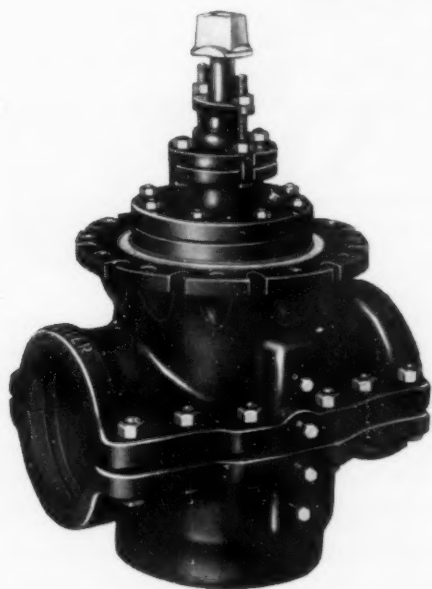
Fluctuation of the water level aids greatly in discouraging the growth of vegetation and should be practiced when the water supply permits. During the winter and spring months the elevation of water in the pond should be held at the maximum until the beginning of the malaria mosquito-breeding season, which is usually around the middle of April or the first of May. Then by dropping the elevation sharply for one or two feet, much objectionable flottage will be stranded. Fluctuation should be continued with a gradual draw-down throughout the summer and early fall. The water should be periodically raised and lowered within the fluctuation limits. By holding it up for about a week, much of the terrestrial vegetation along the margin would be drowned. When it is lowered, the drying out will kill a large part of the aquatic vegetation. Each time the water is raised, the elevation should be one or two inches below the previous high level.

In ponds which are kept clean of vegetation and flottage, small fish, such as the Gambusia or top minnow, if kept in the pond in sufficient numbers, will destroy mosquito larvae before they develop into adult mosquitoes.

On small ponds it should not be necessary to use larvicides if they are properly constructed and kept clean. However, several toxic materials can be successfully applied to mosquito-breeding areas. Paris green mixed in the proportions of one to twenty with an inert dust, such as talc or lime, is very effective for the control of Anopheles mosquitoes, as only this genus feeds at the water surface, but it kills very few of the other species. Petroleum oils, such as kerosene or No. 2 fuel oil, when applied to the surface, kill all types of mosquito larvae and for that reason are usually preferred. The oils can be applied with various types of equipment designed for that purpose. On small ponds an ordinary knapsack sprayer, equipped with a Bordeaux nozzle, has been found to be very satisfactory.



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Radioactive Matter in Water Supplies

ALL NATURAL waters include small—generally infinitesimal—amounts of radioactivity. Rain brings down radioactivity which originates from cosmic sources and from natural radioisotopes. It is calculated that the top 12 inches of soil contains more than 1,000 curies per square mile, some of which is carried into lakes and reservoirs by run-off.

When the weapon-testing program in Nevada was begun it was realized that radioactive matter would be blown into the high atmosphere and carried for considerable distances; and that rain would bring such matter—"radioactive fallout"—to ground and water surfaces. The amount of such fallout has been measured in many places by many investigators since the Nevada tests. The U. S. Atomic Energy Commission, with the cooperation of the U. S. Weather Bureau, has been taking such measurements since 1951 at 89 stations. Measurements were made at Portland, Me. by members of the faculty of the Mass. Inst. of Technology. The laboratory of Chicago's South District filtration plant, which is perhaps the best equipped waterworks laboratory in the country for measuring radioactive contamination of water, makes periodic measurements of radioactivity of rainwater and snow, of lake water and of filter plant effluent. The Lawrence Experiment Station of the Mass. Dept. of Public Health has measured the fallout in rivers and reservoirs after each detonation at Nevada. Measurements were made also at Troy, N. Y., at Cincinnati, O., and other points at various distances from the Nevada testing grounds.

All of these seem to indicate that there need be no apprehension as to dangerous effects from radioactive fallouts. This of course does not apply to the fallout from a nearby bomb explosion. The Atomic Energy Commission found the total fallout up to January, 1956, varied at its 89 stations from 22 millicuries per square mile in California to 260 in Colorado. The radioactivity of the Portland water supply was increased by fallout only one 70,000th of the limit specified by the National Bureau of Standards as permissible for continual use by human beings.

Entirely different is the problem of radioactive wastes created by atomic reactors, and by various handlers of radioactive wastes, prin-

cipally chemical plants which process irradiated fuel elements. These high-level radioactive wastes should not be, but sometimes may be, discharged into water which is being used for public supply. Another possible source is waste water from hospitals which use radium or radioactive isotopes.

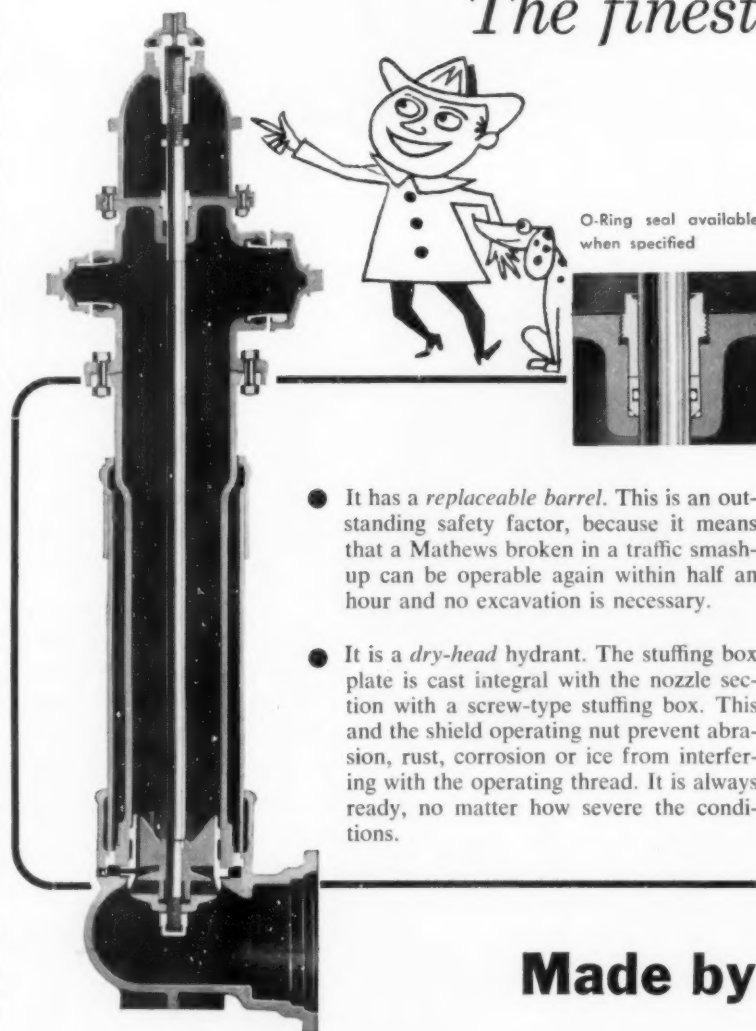
The problem of the water works superintendent is to detect the presence of radioactive material in water reaching their plants and removing it. Experiences in removal

have as yet been few and results various. In 1954 the operator of the Troy, N. Y., filter plant found that about 35 percent of the raw water activity was removed by the filters, probably because the water has a high concentration of manganese, of which 80-90 percent is deposited in the filter sand. No removal of fission products by aeration and sedimentation could be detected. Storage of the filtered water in uncovered reservoirs resulted in a return of the fission products concentration to practically the same as that of the raw water before treatment.

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mission found that one passage of water through a lime or lime-soda softening plant operating at maximum efficiency will reduce radiostrontium activity by 50 percent. Repeated precipitation will remove up to 99 percent. Water treatment plants having separate mixing, coagulation and settling facilities could be adapted to employ this repeated precipitation process.

The Lawrence, Mass., Experiment Station found that filtration through a sand filter gave substantial reduction in radioactivity, chiefly by adsorption, possibly by electrolytic means. The remainder is carried

down by the sludge, which must be disposed of suitably.

The Oak Ridge National Laboratory reported in 1956 that, generally speaking, water treatment processes will not effectively reduce the activity in the water to acceptable safe limits except where the initial levels of activity are very low, certainly several orders of magnitude below 1.0 microcurie per ml level (Equivalent to 3×10^3 ppm). To protect large population centers dependent on surface waters which may become contaminated by radioactive materials, plans should be made for auxiliary water sources

from possible non-contaminated supplies.

This is a digest of the material which appeared in PUBLIC WORKS Digests during 1955 and 1956.

• • •

A Half-Century of Notable Service

On March 18, 1957, Miss Alice L. Webster completed fifty years of service for the citizens of East Orange, New Jersey, 23 of them as Deputy City Clerk and the last 24 as City Clerk. She will be retiring permanently in May after setting what is probably a national record for a woman in city government. In 1907 she became the first of her sex to be employed in the City Clerk's office. In 1910 she was appointed Deputy City Clerk, the first woman to hold that position, and in 1935 City Clerk, following the death of her predecessor, Lincoln E. Rowley. Again she was the first woman in the city's history to conduct that office.

Her career has been synonymous with the growth of a city that has climbed to a population of some 85,000, with a consequent demand for additional services from its citizens. The community has changed from one that was populated almost entirely by commuters to New York to one of varied commercial and industrial business. This has produced expansion in governmental functions and an increase in the duties of the City Clerk.

In honor of the anniversary a reception was held for her by her fellow workers in the City Hall departments in the office of Mayor William M. McConnell on March 18. On April 24 a dinner was given for her in the ballroom of the Suburban Hotel to which more than a thousand city officials, politicians of all parties, city employees and friends were invited. No City official ever received a greater tribute of universal esteem.

• • •

Treatment Plant Built Without Assessment or Installation Charges

A new sewage treatment plant, costing \$1,250,000 is now in operation in North Miami, Fla. More than 98 percent of the 3300 homes are reported to be connected to the sewer system. One-bath homes are charged \$2.50 per month; two-bath homes \$3.50. This charge represents the only cost to the householder, as there were no property assessments nor installation charges.

HYDRANTS...

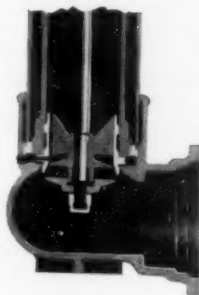
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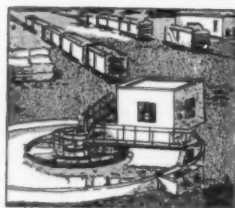
The operating thread cannot be bent. Head revolves 360°. Nozzle sections can easily be changed. Nozzle level can be raised or lowered without excavation. Bell, mechanical-joint or flange-type pipe connections.



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PUBLIC WORKS DIGESTS



THE INDUSTRIAL WASTE DIGEST

Trickling Filter Follows Air Flotation

In a packinghouse waste treatment plant where existing units provided sedimentation and air-flotation, a study was made of the efficacy of a trickling filter for the final stage of treatment. Designed on the basis of the Eldridge formula, the filter was fabricated on the roof of the building housing the air flotation unit. Dimensions selected were a diameter of 14 ft. and depth, 6 ft.; filter media was extended clay tile. Wooden walls were used, made up of 2-in. by 6-in. planks. BOD, oxygen consumed, nitrogen and grease concentration were measured as criteria of performance. The results indicated that following air flotation, a trickling filter will perform satisfactorily with packinghouse waste if proper care is given to assure a constant flow to the filter. Alum treatment of the waste in the flotation unit did not adversely affect the operation of the filter in concentrations up to 20 ppm. When the filter was operated as a high-rate unit with a flow rate of 20 mgad and a recirculation rate of 50 percent, a BOD reduction of 50 percent was obtained, even with BOD loading as high as 4.97 lb. per cubic yard. It would be reasonable to assume that if the BOD loadings were reduced to 2.0 to 2.5 lb. per cubic yard, removals of 60 to 65 percent could be expected. This is substantiated by the fact that during the non-killing hours, BOD loadings of 2.06 lb. per cubic yard resulted in an average BOD reduction of 61.2 percent.

The average reductions in BOD, oxygen consumed, grease, and nitrogen accomplished by all the units employed in this test compare favorably with the reductions given for more conventional combinations of secondary treatment units.

"Packinghouse Waste Trickling Filter Efficiency Following Air Flotation." By K. A. Hirlinger and C. E. Gross, John Morrell and Co., Ottumwa, Iowa. *Sewage and Industrial Wastes*, February.

Air Pollution Control In Cincinnati

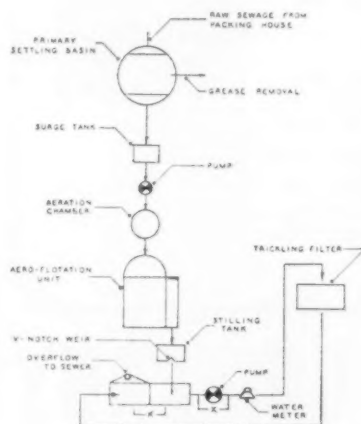
In an area like Hamilton County, Ohio, which has about 20 temperature inversions each October, even old fashioned incinerators and the evaporation of many volatile common products become factors in air pollution. All communities within the County are interdependent on each other in control efforts. If this is recognized, and with the guidance of established agencies plus the help of industry and its research efforts, air pollution control is possible. The Air Pollution Control League of Greater Cincinnati has waged a continuous battle against smoke since its incorporation in 1906. The reduction of sootfall from smoke, dust, etc. amounts to about 50 percent in the last eight years. The smoke nuisance in Cincinnati has been reduced approximately 90 percent. In 1955 the City Manager appointed a committee to study air pollution from automobile exhausts. Recommendations offered include the use of the safety inspection facilities to detect and exclude excessively smoking vehicles, empowering the Police Dept. to require reinspection of suspected smoking

vehicles, prohibiting the idling of engines of buses at terminals for more than three minutes, requiring the use of diesel fuels meeting certain specifications by diesel-powered vehicles, and providing for review of local problems presented by automotive vehicles every two years. The officials of the League have also conferred with officials of the Cincinnati Transit Co. relative to the use of propane or LPG fuel for transit buses. The objectives of the League are to make the public realize that the cooperation of every citizen is required and to develop a team approach to the problem among all communities in the area.

"A Race with Time—the Drive for Air Pollution Control." By C. N. Howison, Executive Secretary, Air Pollution Control League. *Industrial Wastes*, March-April.

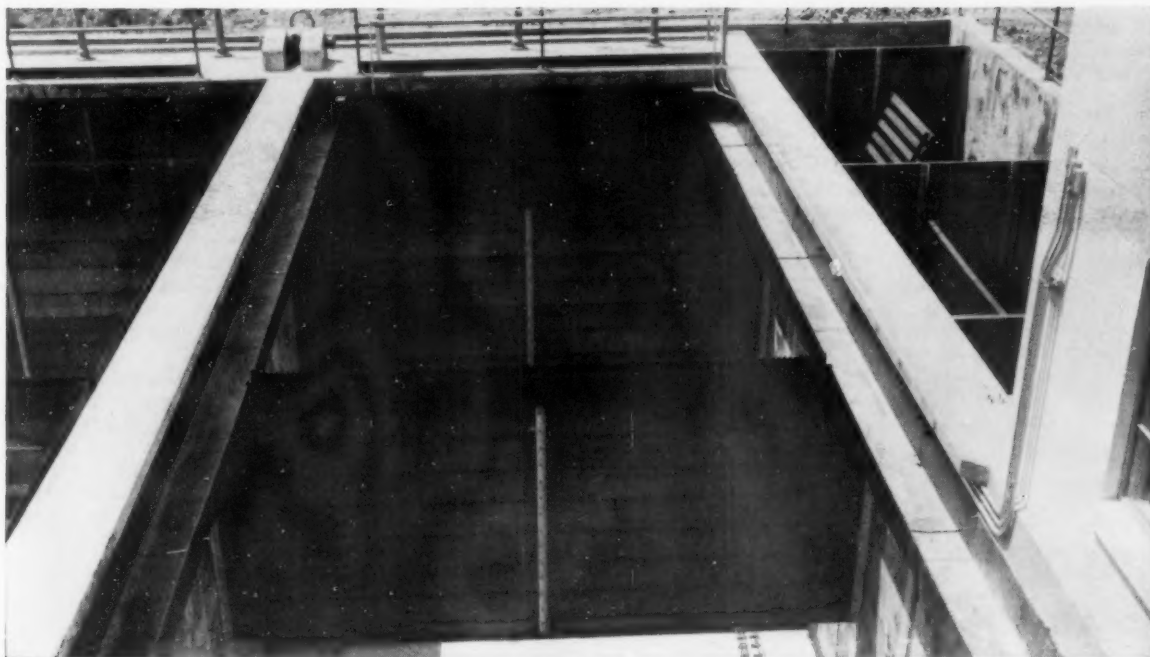
Radioactive Waste Problem Summarized

Nuclear radiations ionize the medium through which they pass, and this ability is responsible for the health hazard due to radiation exposure. Certain elements, if ingested, tend to accumulate at specific body locations, and in the water pollution field, interest is centered in those radioisotopes. Three major factors determining the importance of any specific waste source are the quantity of radioactive material involved, the duration of the waste discharge, and the hazardous nature of the specific radioisotope involved. Nuclear power reactors and uranium processing plants can be major sources of radio-active wastes. The initial refining of uranium bearing ores, and there are about 10 such plants, is an important source of waste. Ore processing wastes may include wash waters, sands and waste solids, and various process liquors. Customarily the wastes are stored in ponds, where the volume is reduced by evaporation and seepage. Only uranium is recovered from the ore and the process wastes include



Courtesy Sewage & Ind. Wastes

● Facilities for the treatment of packinghouse wastes shown are in diagram.



Rex Floctrol and Verti-Flo at Boro of Somerset, Pa., Filter Plant. Consulting Engineers: Gannett, Fleming, Corddry & Carpenter, Harrisburg, Pa. L. J. Whipperman, Plant Operator. Richard Pyle, Boro Manager.

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- 3 Rex Flash-Mixer.** Double-mixing action combines slow rotation with rapid top-to-bottom turnover for most thorough mixing. Results: almost instantaneous dispersion of chemicals...greater efficiency...increased over-all plant capacity.

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all of the radioactive daughters. Radium, no longer of sufficient value to warrant refining, is a bone-seeking alpha emitter with a half-life of 1,620 years, and is considered to be the most dangerous of all radioisotopes. Nuclear reactors for power and other purposes represent a potentially great source of radioactive waste material. The primary coolant, despite pretreatment will contain traces of metals and small quantities of corrosion products picked up in the circulation system. In passing intimately through the reactor core it will be heavily bombarded by neutrons, and some

of the impurities in the coolant will be made radioactive. The coolant may also be contaminated by rupture or failure of a fuel element in the reactor core. Discarded coolant at Shippingport, Pa., will be stored to allow for some decay of radioactivity and then will be treated by ion exchange. Other sources of wastes will include ion exchange resins, laundry wastes, and laboratory wastes. Radiophosphorous, one of the waste constituents at Hanford was found to be concentrated more than 100,000 times by certain small fish in the Columbia River. The use of con-

taminated river water for irrigation could result in a hazard of direct public health significance. The control of radioactive waste discharges to surface water is a problem in principle no different from that in any other industrial waste. It is considered especially important that pollution be controlled on a basin-wide basis insofar as possible, and effective control requires that regulatory agencies concern themselves with the problem in the early stage of planning. In monitoring for background radioactivity, samples should include water, biological life, and river mud or silt samples. At present, at least, the goal should be no radioactive contamination of air and water, if it can be accomplished.

"Sources and Control of Radioactive Water Pollutants." By E. C. Tsivoglou and W. W. Towne, R. A. Taft Sanitary Engineering Center, U. S. Public Health Service, Cincinnati. *Sewage and Industrial Wastes*, February.

Wet Scrubber for Lime Plant Dust

The Warner Co. in Bellefonte, Penna., had made efforts to control dust and other materials from its lime operation since 1921, but these efforts were not fully successful until the present system of using wet scrubbers was adopted. Settling devices used by the plant in its early days were of some value, but permitted the escape of large amounts of dust. Between 1942 and 1945, cyclone collectors were installed on all three kilns. In 1949, a full size spray tower with drip tile filters was installed to service two kilns. The most successful, however, was a modified type of Holland wet scrubber installed on the third kiln in 1952. It employs a paddle wheel in a tank of water to create the spray which cleans the gases and arrests the dust from the kiln. Similar arrangements have been or will be made for all kilns. A sludge thickener is used for collection and disposal of the solids which ultimately go to settling pits. The spray water, in passing through the collector, reaches a temperature of about 140 degrees F and picks up 2 percent solids, which are removed in the thickener. Rubber-lined pumps are used to move 2,000 gpm of clear water to the scrubbers, and Morris pumps are used to pump slurry from the sludge thickener to settling pits.

"How To—Prevent Stream and Air Pollution." By Edgar R. Malory, Warner Co., Bellefonte, Penna. *Industrial Wastes*, March-April.

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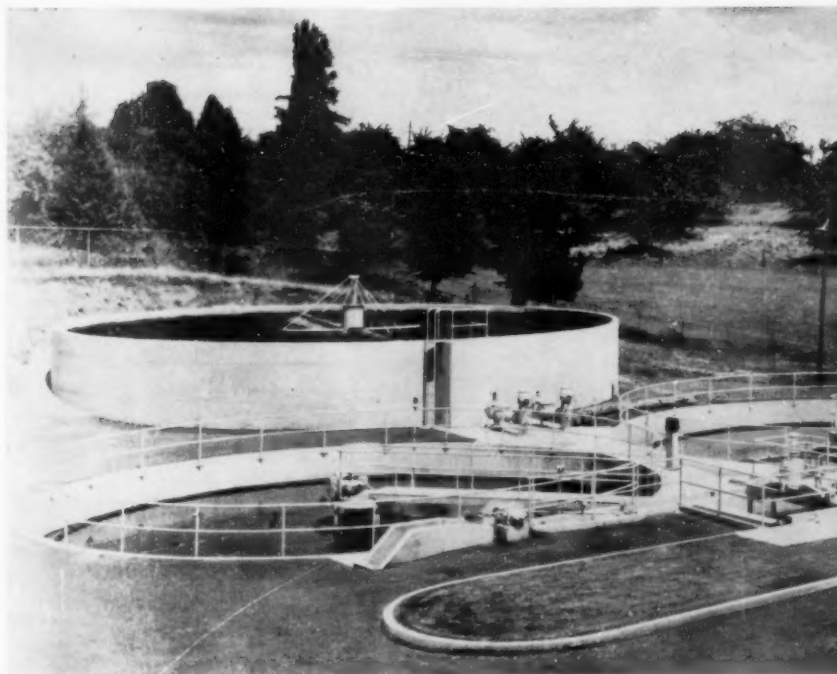
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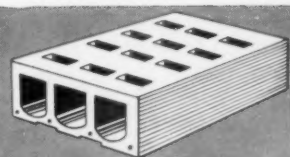
Designing engineers may address any manufacturer member listed in panel at right for HANDBOOK OF TRICKLING FILTER DESIGN—free



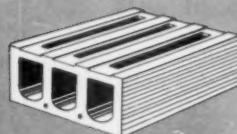
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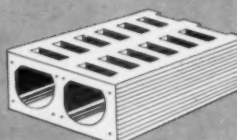
PUBLIC WORKS for May, 1957



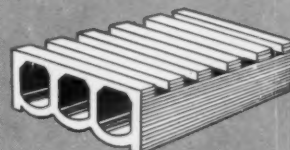
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Kansas City 6, Mo.



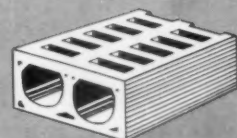
POMONA
Pomona Terra-Cotta Co.
Pomona, N. Car.



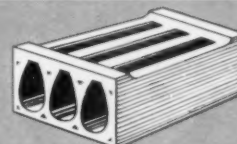
ARMCRE
Ayer-McCord Clay Co., Inc.
Brazil, Ind.



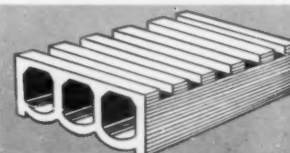
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Mineral Wells, Texas.



BOSCO
Bowerston Shale Co.
Bowerston, Ohio



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Natco Corporation
327 Fifth Ave.
Pittsburgh 22, Pa.



TRANSLOT
Cannelton Sewer Pipe Co.
Cannelton, Ind.

Cannery Waste Disposal Economics

Liquid wastes from fruit and vegetable canning consist mainly of large volumes of water necessary for washing the produce, plant sanitation, sanitary transfer of cleaned and prepared food, and cooling cans. A waste strength of 500 ppm suspended solids will be exceeded unless screening is provided. The choice of the method of disposal of solid garbage from canneries is made after comparing costs of disposing on land or for recovering as meal and costs of disposal

by dumping and handling remaining amounts, as suspended solids in waste flow to sewers. Liquid wastes disposal involved consideration of the following methods: dilution in a body of water after minimum treatment, dilution after sufficient primary and secondary treatment to permit discharge to an otherwise insufficient body of water, spreading on land or storage for release when dilution water is available. Because the term "population equivalent" fails to provide for seasonal fluctuations in quantity of wastes, a parameter described as "green-ton equivalents" has been

devised. If the combined flow of cannery waste and domestic sewage has a BOD value greater than 450 to 600 ppm, all practical steps should be taken to provide for separate collection and treatment of the cannery liquids. The problems encountered in treating strong combined sewage and cannery wastes will be simplified by continued population growth. With continued population growth, difficulties will increase in the disposing of solid wastes as garbage. Special attention must be given to the magnitude and seasonal character of the "garbage" phase of cannery wastes disposal in developing area-wide long range plans. Only the conversion of selected portions of "prime" garbage, which is rich in sugars, nitrogen, or other valuable solubles has shown any promise. Even then, the probable increased use of solids wastes will be as fertilizer or for stock feed. The latter is feasible only when costs of drying are carefully managed.

"California Fruit and Vegetable Cannery Waste Disposal Practices." By W. J. O'Connell, Consulting Engineer, Burlingame, Calif. *Sewage and Industrial Wastes*, March.



HIGHLY MANEUVERABLE Model "80" sweeps easily around parked cars.

NEW! for CLEANER sweeping at less cost...

TENNANT Model 80 POWER SWEEPER

Specialty engineered for EXTRA-clean sweeping, this compact unit offers an important NEW way to sweep congested areas.

Built for fast, low-cost operation, it's a maneuverable 1-man machine... rapidly sweeps parking lots, ramps, city garages, sidewalks, arcades, auditoriums, etc.

Provides Almost 100% Dust-Free Sweeping

Results are dramatic!...Exclusive brush-plus-vacuum system eliminates usual dribbling, assures ultra-clean work. No water spray needed. Sweeps up all loose dirt, dust and litter on-the-run. *Write for details on this new CLEAN-sweeping machine.*

FEATURES

- Assures EXTRA-CLEAN sweeping; needs no water spray.
- Works easily in traffic.
- Sweeps approx. 4½ ft. path.
- Dumps hydraulically in 10 seconds.
- 5-minute broom change.
- Versatile—ideal for both indoor and outdoor areas.

G. H. TENNANT CO., 755 North Lilac Drive, Minneapolis 22, Minn.



POWER SWEEPERS

SETS A NEW STANDARD IN CLEAN SWEEPING

Incineration of Solvents In Pharmaceutical Wastes

The Upjohn Co. uses a two-stage trickling filter unit for most of the water-borne wastes of reasonable strength. Those from antibiotics manufacture are pretreated by extended aeration to equalize fluctuations in flow and strength and to help stabilize BOD and to remove part of the volatile solvents. Wastes too strong for biological treatment or otherwise unsuitable are discharged to 1200-ft. wells. Because of strict precautions necessary in preparing substances for human consumption, few waste recovery operations are possible; certain solvents, however, can be recovered because they are definite chemical compounds and can be subjected to purification by distillation and rectification. If solvents are mixed, they cannot be recovered and are destroyed by incineration. The liquids are pumped or otherwise transported as necessary to a 2500-gal. receiving tank and thence to an agitated 10,500-gal. holding tank. This provides blending and equalization. The mixed solvent is then pumped to a 400-gal. cooling and settling tank and from there to screens and the burners of the incinerator. No ash or residue results from the incineration of waste solvents. Facilities are provided for



Where performance is the measure

F-M Power is the standard

Baltimore's fireboat *Mayor Thomas D'Alesandro Jr.* has four O-P's totaling 2640 hp. for propulsion and pumping service. Designed by Thomas D. Bowes, M. E., Naval Architect.

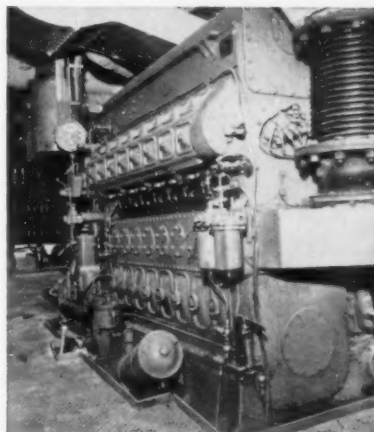
Floating Pumping Station Powered by Fairbanks-Morse Opposed-Piston Diesels

Fire alarms sounding today in Baltimore's expanding harbor area are quickly answered by the newest in fireboat performance. Cousin to land-based municipal pumping stations, the vessel is powered by a pair of 660 hp. Fairbanks-Morse Model 38F 5¼ Opposed-Piston Diesels. This highly maneuverable vessel sails smoothly at full speed, completely without vibration and crash-reverses in less than two lengths.

Another identical pair of O-P's power the two 10" F-M fire pumps that can throw 12,500 g.p.m. at 150 lb. pressure.

Only compact Opposed-Piston power could provide this performance, yet keep weight down for higher top speed.

On a fireboat—in your municipal power or pumping station—when the need is for dependable power produced economically, you cannot match the standard set by Opposed-Piston diesels from 200 to 2400 horsepower. Fairbanks, Morse & Co., Dept. PW-5, Chicago 5, Illinois.



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Dodson's Digest



A roadside restaurant solves a dust problem

Stopped at a roadside restaurant the other day. Even though it was lunch time, the place was practically empty. I mentioned this to the proprietor.

"I can't understand it," he said. "I've got a good location here, on a well-traveled highway. I serve only the best food. I've got signs plastered all over the place. But I still can't build much of a trade."

"It's pretty dusty around your building," I pointed out. "That keeps a lot of customers away."

"I've thought of that," he said. "And as soon as I make enough money, I'm going to pave the whole area. But I never seem to get enough money ahead to . . ."

"That's a vicious circle," I broke in. "You can't build your business until you get rid of the dust, and you can't get rid of the dust until you build your business."

"I'm afraid you're right," he sighed. "I wish there was an answer."

"There is an answer," I said. "Use Calcium Chloride to keep the dust down."

He looked puzzled. "Calcium Chloride? What's that?"

"Calcium Chloride is what state highway departments use," I explained, "to keep their roads dust-free. And it's inexpensive and easy to use. All you have to do is apply one pound of Calcium Chloride for each square yard of gravel, and re-treat the area with a half pound per square yard when the surface shows signs of dust . . . usually two pounds of Calcium Chloride is all that's needed for a dust-free summer season."

"It's worth a try," he conceded, glancing out the window. "Nobody but a starving man would stop at a dust bowl like this."

"You're absolutely right," I agreed. "Where's your menu?"

—L. D. DODSON

P.S.—Our leaflet, "How to Stop Bother-some Dust," gives hints on how to solve dust problems with Wyandotte Calcium Chloride. A note to me will get your free copy in the mail to you. *Wyandotte Chemicals Corporation, Wyandotte, Michigan. Offices in principal cities.*

Wyandotte
CHEMICALS

MICHIGAN ALKALI DIVISION
HEADQUARTERS FOR CALCIUM CHLORIDE



combustion of 1600 to 1800 gallons of waste per 16 hours.

"Waste Solvent Incineration Successful at Upjohn Co., Kalamazoo, Mich." By C. F. Gurnham, Michigan State University. *Industrial Wastes*, March-April.

Other Articles

"Dairy Waste Disposal by Spray Irrigation." By Frank J. McKee, Kraft Food Co., Chicago. *Sewage and Industrial Wastes*, February.

"Discharge of Industrial Wastes into Municipal Sewer Systems—A Panel Discussion." By F. W. Crane, Buffalo Sewer Authority; D. B. Stevens, New York State Dept. of Health; R. W. Hess, Allied Chemical and Dye Corp.; G. P. Fynn, Buffalo Sewer Authority; A. J. Gabaccia, American Cyanamid Co.; C. C. Spencer, Erie Co. Health Dept., Buffalo, N. Y. *Sewage and Industrial Wastes*, February.

"Wastes Treatment Facilities at United States Air Force Installations." By John E. Koruzo, Chief, Sanitary Section, Engineering Branch, Directorate of Construction, U. S. Air

Force. *Sewage and Industrial Wastes*, March.

"Industrial Waste Treatment at Modesto, California." By Marvin Ray, Director of Public Works. *Sewage and Industrial Wastes*, March.

"Research Shows Effect of Crystal Seeding by Return Sludge." By A. D. Faust and H. E. Orford, Rutgers University. *Industrial Wastes*, March-April.

"Treatment of Trade Waste from British Celanese Factory at Derby." The Surveyor and Municipal and County Engineer, March 9.

Volume of Roadside Rubbish and Debris

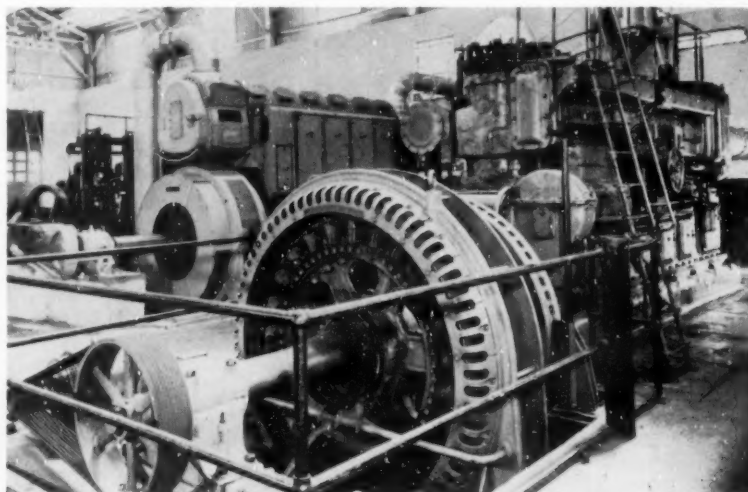
From 130.44 miles of State Trunk lines in Marquette Co., Mich., County forces removed 852 tons of roadside rubbish and debris in 1956; and from county roadsides 430 tons. There are 279.71 miles of County Primary roads and 991.26 miles of County local roads. H. L. Shroeger is Superintendent-Engineer of Marquette Co.

How a Municipal Power Plant Increased Its Revenues

A FEW YEARS ago, the municipal electric plant of Wauchula, Fla., decided to encourage the use of electric ranges, water heaters and other home appliances by offering to install them free. The city bought the materials and paid electricians a flat fee to make the installation. The total cost averaged \$33.90 per installation. In two years about 200 stoves and water heaters went in and the increased use of electricity paid off the investment in one year.

The Wauchula plant has five Fairbanks-Morse diesel engines with

a total of 3,955 horsepower. Latest unit installed was in 1955 when a 1280-hp opposed piston diesel was added. The plant has been highly successful, both financially and in furnishing steady and reliable power to the community. The receipts of the Light & Water Department in 1955 amounted to more than \$253,000, while the costs of operation were only about \$131,400. Average production for the plant, with five engines (one dates back to 1925) was 12.46 kwh per gallon of fuel consumed.



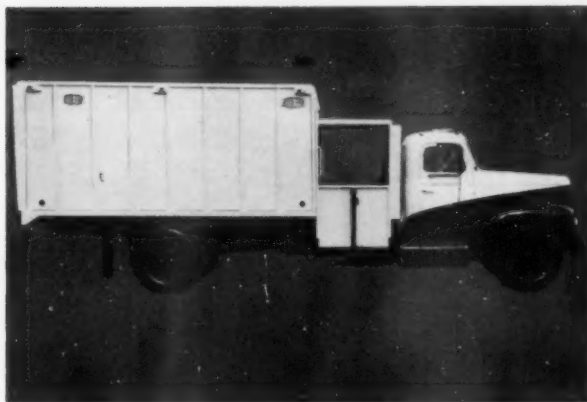
● INTERIOR of the diesel-powered municipal electric plant at Wauchula, Florida.

PROVEN BY COMPARISON

HYDEPAK

delivers a greater
payload at a much

LOWER COST



YES, in test after test HYDEPAK refuse collection bodies have proved to be second to none Check for yourself the outstanding features of HYDEPAK.

OPERATION: Costs are less because HYDEPAK packers have been designed for lighter, less costly truck bodies. Design also has eliminated large crews for loading and high compaction allows for a bigger load cutting down mileage expenses.

MAINTENANCE: HYDEPAK has a minimum of moving parts that might break down and cause expensive repairs and loss of time. There is no other unit that is as easily maintained as the HYDEPAK, this means savings . . .

CAPACITY: Every available cubic foot of the unit is utilized for storage and not for the operating machinery. Comparison has proven that high compaction under pressure enables this unit to make more pickups per load than any other packer of equal weight and capacity.

ORIGINAL COST: The simplicity of design of the HYDEPAK results in lower initial cost. Regardless of cost none can outperform the HYDEPAK.

HYDEPAK refuse collection bodies are available in 13 yd., 16 yd., 20 yd. and 24 yd. capacities.

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PROMOTING A CITY-WIDE STREET IMPROVEMENT PROGRAM



FOR FORTY years the people of Great Falls, Montana, had hoped with every new mayor that the streets would be fixed. And each year for forty years, the new mayor found that the money was not available. So, all this time, little more than maintenance and low-cost surfacing in new sections was completed.

Two years ago the Kiwanis Club members decided to do something about their streets. They knew the city did not have enough money to finance the project; and they knew the method of building a few good streets here and there around the city wouldn't work, because every time one was repaired, this became the one used by all the traffic; and it soon was like the rest. So the Kiwanis went out to sell the entire city on new streets.

First, they had to get 25 percent of the people to sign petitions to create the paving district. The Public Affairs Committee divided the city into ten 50-block sections, with one man assigned to each block. Most of the other service clubs joined in the campaign with the Jaycettes adding 50 members to the solicitors. Starting in August, by Christmas the required names had been gathered. No action was taken by the city council until after elec-

tions in May. The street problem was not a campaign issue. In July, the proposed program was turned over to Harold Hoskins & Associates, consulting engineers of Great Falls. A special improvement district was established by the city council, the largest single district ever formed in Montana and encompassing 7500 lots. Under the plan, the maximum estimated assessment for a lot 50 by 150 ft. would be \$615. Where little work would be required, as merely pavement rehabilitation, a minimum of \$197 would be assessed. Assessments



● **SOFT spots in old streets were dug out to eliminate possible future trouble.**



● **SAND and gravel fill will replace material that is removed by scrapers.**

would be spread over 15 years and everyone on a block street pays the same, even on corner lots.

No organization opposed this program—were all thoroughly sold beforehand. It passed the city council 8 to 2; and only 198 protests were lodged, out of a possible 8000. The 5 percent tax-exempt bonds were sold easily on competitive bid to Grande and Company, Denver, Colorado. A contract was let in March, 1956, for the city-wide sewer project, a necessary job before the streets could be finished. This cost \$1,571,856.

Four Great Falls contractors combined to bid the street project for \$4,186,721. Working under the title City Constructors, the four com-

panies are McLaughlin, Inc.; S. Birch and Sons Construction, Inc.; S. Birch, Inc.; and Nilson - Smith Construction Company. R. L. Anderson, Missoula, Montana, was named project manager. Engineering work by Harold Hoskins and Associates cost \$311,910.

For the work, the city was divided into three north-south sections. Nilson-Smith took the eastern third, S. Birch and Sons and S. Birch, Inc., the central section, and McLaughlin the western third. Each contractor had about 300 block-streets to resurface. This left a few arterial streets to be let by the Montana Highway Department, on which state and federal funds would also be used.

Plans provided that each street would have new or repaired curbing with 6 inches exposed; residential streets would be built up with 4½ inches of sand, compacted 95 percent, for drainage, 5 inches of sandstone gravel and 2 inches of asphaltic cement; arterial streets received 5 inches of sand, 8 inches of gravel, and 3 inches of asphaltic cement.

Each contractor worked his section differently from the others. Nilson-Smith used four Cat DW10 scrapers for the major excavation. Pushloaded by a D8, the DW10s hauled out about 1100 yards per block-street, bringing the streets to



Photos courtesy Caterpillar Tractor Co.
● **SPREADING gravel over shaped sand base of one of the residential streets.**

**"WE CONSIDER BLAW-KNOX
STEEL STREET FORMS
IN THE TOP BRACKET OF
OUR BEST INVESTMENTS"**

**HUGH MURRAY
LIMITED**

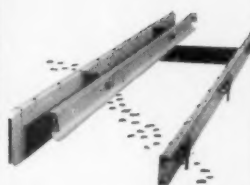
Successful use of Blaw-Knox Steel Curb, Curb and Gutter Forms caused Hugh Murray Limited of Belleville, Ontario to make the following statement: "They have seen considerable service yet, with a little care, have remained in perfect condition. A cost analysis conducted into the various methods and materials used in similar cases proved the value of Blaw-Knox forms." After one job you will be convinced that Blaw-Knox are your best investment, too. One "Complete Package" of these forms handles every concrete curb, curb and gutter, integral curb or sidewalk job from simple straight work to curved and serpentine shapes. They are standardized and completely interchangeable so you can do the most work with the smallest investment in forms. These forms are fast and easy to set or strip, and practically eliminate hand finishing. The need for expensive carpentry and costly single-use materials is eliminated, too.

The forms shown at right are but a few of the many types available — for complete information see Bulletin 2259-R. Your nearest dealer has it or you can write direct to Blaw-Knox for it.

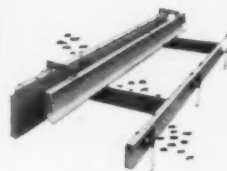
**SAVE
ON
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FORMS**

Self-aligning road forms save time and materials on highway and airport paving, too. They will assure rapid form setting that is always true to line and grade. Road forms are available in heights of 6" or more and Airport forms in heights of 12" or more.

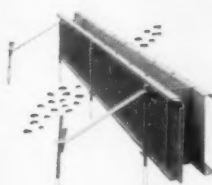
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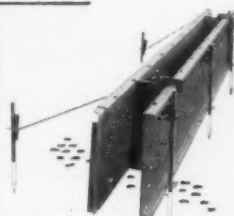
Curb and Gutter Forms



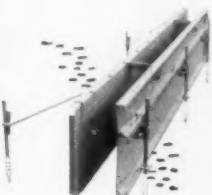
Curb and Gutter Forms



Curb Forms,
vertical back and face



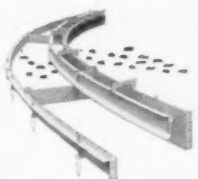
Curb Forms vertical back
with battered face



Curb Forms,
battered exposed face



Integral Curb Forms



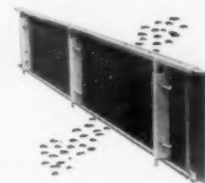
Fixed Radius Forms



Flexible Radius Forms



Sidewalk Forms



Curb Forms

BLAW-KNOX COMPANY

CONSTRUCTION EQUIPMENT DIVISION

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**the most complete
SWIMMING
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**CATALOG & INFORMATION
MANUAL in the industry!**



Send for this valuable 52-page guide-book. Contains authoritative information about pool maintenance. Gives prices, photographs and data on all the latest pool equipment and supplies. Fully describes over 100 pool products manufactured by Modern — largest, oldest firm specializing in the manufacture of every item to build or maintain any pool—including filters, drains, skimmers, ladders, lights, observation windows, diving boards and stands, paint and chemicals; famous for quality since 1935.

For **FREE** copy, write today for Catalog & Data Book 13E.

For pool supplies order direct or from nearest Modern distributor. See classified telephone directory for local distributor or write us.

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modern SWIMMING POOL CO., INC.
One Holland Avenue, White Plains, N. Y.
Manufacturers of Swimming Pool Supplies Since 1935

rough grade. Cleanup and excavation of soft spots was handled by a Cat No. 6 shovel. Two DW10s pulling bottom dump wagons filled in the soft spots. Three Cat No. 12 motor graders worked with the scrapers, finishing the roadbed and spreading sand and gravel.

Once the base was brought to rough grade, the motor graders scarified the underlying clay. It was then watered and compacted by a Buffalo - Springfield Kompactor to 95 percent. The sand was spread and compacted with a Ferguson rubber-tired roller. The Kompactor then came back to pack the rock. Dutch Williams, superintendent for Nilson-Smith, is working about 3 block-streets each day. So that fire trucks can get through in emergencies and public and private vehicles can make pickups and deliveries, the streets are worked in a grid pattern. Even numbered streets are worked to the intersections, leaving odd numbered street open. When these are completed, the odd numbered streets are picked up. Then work will cross on the avenues.

S. Birch and Sons and S. Birch, Inc., working together, are using tractor-shovels and tracks for most of their excavation. Old curb and guttering and excavation for new curbing is handled by a Gradall. A Cat No. 977 and an HT4 Traxcavator and an AC HD20 shovel dig out the soft spots and load into a fleet of contracted dump trucks. On the north side of town, broken concrete is hauled to extend a parkway along the river. On the south it is taken to a rock quarry. Three No. 12 motor graders follow the excavation, spreading fill and shaping the road bed. Trucks dump the sand and gravel along the center of the street to be spread by the graders. A Minneapolis-Moline with a backhoe handles odd jobs. Sand is compacted by a Tampo 9-wheel roller and clay and rock by a Hyster Grid Roller pulled by a Cat DW10. The superintendent on this section is Larry Mahan.

On the west side, McLaughlin, Inc., has run into the most difficult section because of the tough surface on the old roads. Most of the old oil had to be ripped up by a D8 pulling a No. 28 ripper. This ripper also handled the small amount of old concrete pavement in this section. Red Muir, general superintendent, is using two scraper fleets to handle the about 1100 yards of excavation in each block-street. In one, two DW21s are pushloaded by a D8. In the other, three Cat DW10s are

pushloaded by a D8 or a No. 12 motor grader. A Cat HT4 Traxcavator is used for cleanup-work. Seven No. 12 motor graders shape the roadbed and spread the fill. Sand is compacted by two Tampo wobble-wheel rollers. Clay and rock are packed by a Galion steel-wheel roller. Special tamping and breaking up concrete is handled by a Hydra Hammer.

Work was begun on the streets in Great Falls on June 20, 1956. About one fourth of the streets were completed by the fall of 1956; the remainder will be finished by November, 1957. This will put good all-weather surfaces on almost all the streets, except for some in the western and southern areas which are thinly populated. Many problems have arisen, and many people have complained about the dirt and difficulty in getting around town; but, as R. L. Anderson, project manager for City Constructors, has pointed out, when a city does in two years what normally takes 15 years, a few problems do come up.

And the protests have been disappearing quickly as the broad, smooth streets, good for many years to come, are opened to traffic.

• • •

**Restaurants and Service Areas
for a Toll Road**

For the Northern Illinois Toll Highway, eight restaurants in combination with gasoline station facilities will be provided. The design provides for a structure spanning the highway, with the restaurant located on the bridge. This offers access from both sides of the highway with equal convenience, eliminating the need for either a separate structure or for a tunnel or overpass. It also reduces the area of land required. Original plans called for only two restaurants.

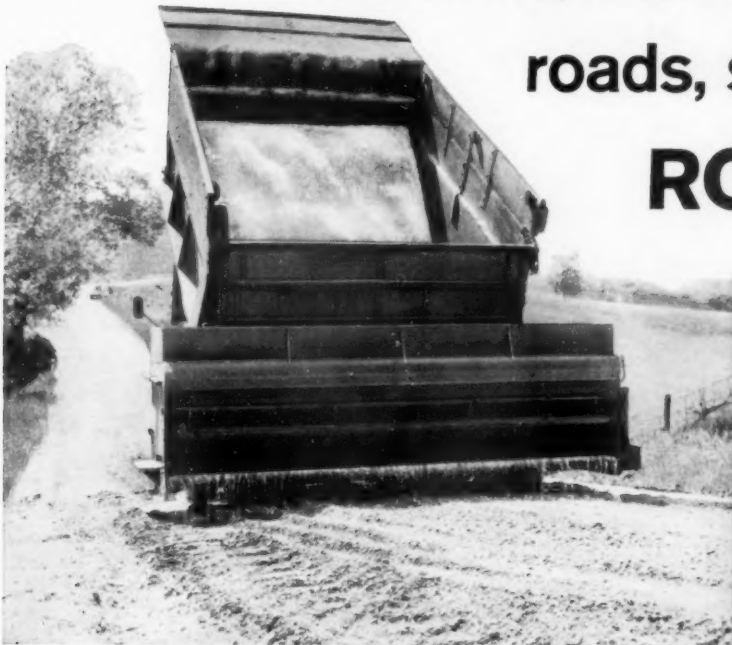
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**Toll Revenue on the
New York State Thruway**

The New York State Thruway has announced that gross toll revenue on the cross-State superhighway in February, 1957, totalled \$1,293,512.55, an increase of 21.4 percent over the \$1,065,518.35 of February, 1956. The total income in February, including tolls, concession revenue, a pro-rated share of Annual Permit sales and sundry income, was \$1,524,844.73 or 24.7 percent higher than the \$1,222,687.98 in the comparable 1956 period.

PUBLIC WORKS for May, 1957

Here's why 29 states stabilize roads, shoulders with **ROCK SALT**



LOW INITIAL COST. Stabilization with Sterling Rock Salt is quickly accomplished. On most jobs, the salt is simply mixed with aggregate, wetted down, and rolled until the surface is hard and compact. Special equipment is not needed. And labor costs can be kept at a minimum.



GREAT DENSITY, RESISTANCE TO MOISTURE are two important features of salt-stabilized soil. Result: roads resist weathering, cost less to maintain. Also, when Sterling Rock Salt is used to stabilize a gravel wearing course—the surface is hard, long-wearing, almost dustless even in dry weather.

SERVICE—With your Sterling Rock Salt Stabilization procedures vary with particular soil and road conditions. For expert advice on stabilization in your area, contact International. An International "Salt Specialist" will give you facts and figures on stabilization jobs, on salt storage and handling. He'll work with you on application procedures, costs, specs, etc. And he'll

help you fit stabilization into your other road work. Contact the sales office nearest you . . . Atlanta, Ga.; Chicago, Ill.; New Orleans, La.; Baltimore, Md.; Boston, Mass.; Detroit, Mich.; St. Louis, Mo.; Newark, N. J.; Buffalo, N. Y.; New York, N. Y.; Cincinnati, O.; Cleveland, O.; Philadelphia, Pa.; Pittsburgh, Pa.; and Richmond, Va.

In the majority of cases, Sterling Rock Salt is chosen for this modern stabilization work. Sterling Rock Salt—when used for stabilizing base courses, shoulders, and gravel roads—improves road durability and reduces costs in a number of ways.



ANTI-FREEZE ACTION.

Sterling Rock Salt in stabilized aggregate reduces the freeze point to 25°F. or below. Thus, the occurrence and severity of frost heaving are greatly reduced. And surface breakup is minimized.

STERLING ROCK SALT
PRODUCT OF INTERNATIONAL SALT CO., INC.
SCRANTON, PA.

THE HIGHWAY AND AIRPORT DIGEST

Placing of Select Subgrade Materials

Select subgrade materials must be employed for the foundations of pavements on the federal road program. The considerations discussed in this article apply to the material content, selection, placing, and treatment required to provide an economical heavy-duty pavement that will be relatively maintenance free. Regardless of the pavement design chosen, the function of the select subgrade material is to provide adequate bearing for the full frequency and magnitude of the traffic load, to permit the drainage needed under the pavement, and to give adequate protection from frost heave and spring thawing in the particular geographic region under consideration.

"Placing of Select Subgrade Materials—Heart of the Highway." By J. D. Welch, A. M., ASCE, Chief Soils Engineer, Howard Needles, Tammen & Bergendoff, Consulting Engineers. *Civil Engineering*, March.

Prestressed Precast Bridge Deck

A prestressed precast bridge deck was erected in eight days in Montgomery County, Pa. The bridge consists of four identical spans of 72 ft. 2 in. and two identical end spans of 45 ft. 3 in. Each span is made up of eight hollow box-girder beams 36 in. wide. The beams in the 72-ft. spans are 33 in. deep, while those in the 45-ft. spans are 21 in. deep. The bridge was designed for the standard H20-S16 loading. The beams are of pretensioned bonded design and are hollow. The hollow space extends the full length of the 72-ft. beams except for solid diaphragms at the ends and at the third points. The sides and bottom of these beams are 4½ in. thick, and their top, 5 in. thick. The prestressing tendons consist of 41 strands of ¾-in. diameter lying in a horizontal trajectory, and stressed initially to 150,000 psi. Conventional reinforcing steel consists of inverted U-shaped No. 4

bars and No. 6 bars. The hollow space in the 45-ft. beams is in the form of two hollow tubes of 12½ in. diameter, extending the full length, except for solid sections at the ends and mid span. Prestressing tendons consist of 31 strands of ¾-in. diameter. Reinforcing steel consists of inverted U-shaped No. 3 bars and No. 5 bars.

"Prestressed Precast Bridge Deck Erected in Eight Days". By James B. Long, M. ASCE, Consulting Engineer, Blue Bell, Pa. *Civil Engineering*, March.

Chemicals Used in the Control of Weeds and Brush

The use of chemicals to control weeds and brush does not eliminate the use of the mowing machine, but it does make a mowing machine much easier and cheaper to use in Clay County, Kansas. For the control of brush 2,4,5-T is used and 2,4-D is used to control the broad leaf plants. Equipment consists of a John Bean all-purpose sprayer with a road-side spraying nozzle mounted on the front of a ¾-ton pick-up truck. For ordinary control of weeds, the average application is three pounds actual 2,4-D acid per mile and spraying is started each May. The cost of weed control by chem-

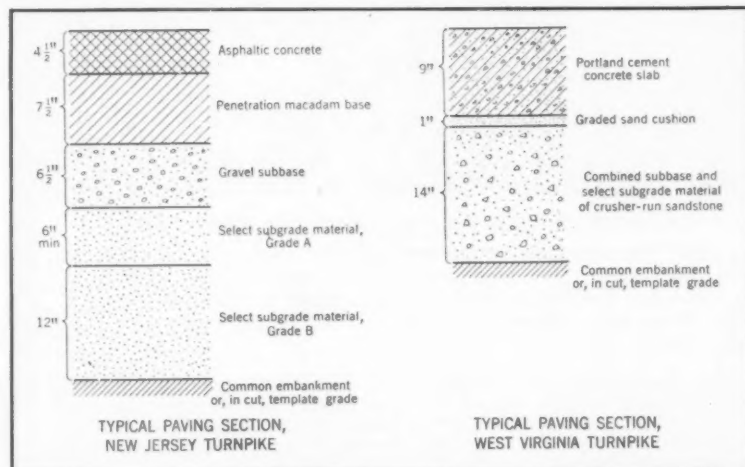
icals runs about \$4 to \$6 per mile. The total cost of the control of weeds, including the mowing, is approximately \$24 per mile. Sumac, wild plum and hedge root are controlled by a spray composed of half 2,4-D and half 2,4,5-T mixed with water.

"Controlling Road-Side Weeds and Brush By Use of Chemicals." By Maloy Quinn, Clay County Engineer, Clay Center, Kans. *PUBLIC WORKS*, April.

Additives in Cut-Backs and Asphalt Cements

Additives in asphalt change a few of the inherent properties of the asphalt without affecting those required for a good pavement. First, the surface tension of the asphalt is lowered. This results in quicker and more even coating of the paving aggregate. Second, the aggregate retains the coating. Water no longer can displace the coating, and thus cause stripping and the raveling which results. Third, cut backs, especially, are able to displace water from the aggregate surface and coat wet aggregate. Various applications are discussed and examples of use are cited, particularly in hot mix asphaltic concrete.

"The 'When' and 'Why' of Addi-



Courtesy Civil Engineering

● **SUBGRADE** is designed to supply as firm a foundation as possible for the pavement, no matter whether the surface is of bituminous materials or cement concrete.

"OUR NO. 212 IS PLENTY ABLE TO DO ALL THE WORK WE NEED"

H. D. Flowers, Street Supt., Lincoln, Calif.



The city of Lincoln, in Placer County, California, has 35 miles of roads and streets to maintain. A Caterpillar No. 212 Motor Grader does the ditching, blades the shoulders and spreads mix. In over five years of steady work the machine has been out of service only twice—to have the tires recapped and one starting engine overhaul only.

Street Supt. Flowers says: "Our No. 212 is easy to get around with and it's plenty able to do all the work we need. There's a big saving in fuel over other graders the city has owned. The full revolving circle on the blade saves time, too. And for long, dependable, economical operation, it's outstanding."

Many cities and counties find the CAT* No. 212 meets all their needs. It's the smallest and lowest-priced grader in the Caterpillar line, but it's ruggedly built to do everything the larger machines can do. It just takes a little more time. The 50 HP Caterpillar

Engine is tough, simple, dependable, and burns such low-cost fuels as No. 2 furnace oil without fouling. With its positive-acting controls, full range of blade positions and excellent job visibility, the machine is easy to operate. New tubeless tires, at no extra cost, do away with tube and flap trouble and cut down time.

The No. 212 may be just the grader needed to do a job for your taxpayers and save them money. Ask your Caterpillar Dealer for a demonstration on your own roads. His reliable parts and service facilities stand behind your investment.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR*

*Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

**BUILT FOR
THE HARD WORK**

JACKSON VIBRATORY COMPACTORS

TERRIFIC TIME SAVERS ON ALL THESE APPLICATIONS:



BLACKTOP PAVEMENT PATCHING

The manually guided Jackson Vibratory Compactor delivers up to 4200 2-ton blows per minute, is self-propelling and will compact bituminous mixes in 5" layers close to maximum density at the rate of 1800 sq. ft. per hour. Operated from a power plant mounted on an auto trailer with device for quickly picking up and lowering the compactor, this is positively the most advantageous outfit ever offered for patching blacktop pavement, paving drives, walks and similar applications.

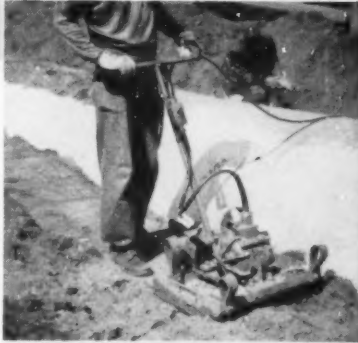
It's equally efficient in compacting granular soils in bridge approaches, water, sewer and gas mains and laterals, sub-bases of pavement widening projects, sub-bases of concrete floors, in trenches (interchangeable bases from 12" to 26" available), and dozens of similar applications. 100% of specified density is readily achieved in 10" layers. The Power Plant is fully capable of operating two of these compactors simultaneously and in many instances labor costs can be cut in two by use of the twin-unit shown at right.

For consolidating base courses of rock, slag, gravel and sand in waterbound and penetration macadam construction the Jackson Multiple Compactor is indeed outstanding. It is used on practically all of the important paving jobs in the nation. By all means write for the complete facts.



**TWIN UNIT
DOUBLES PRODUCTION**

BACKFILL TAMPING



CAMPACTING IN TRENCHES, ETC.



MACADAM CONSTRUCTION



**JACKSON
VIBRATORS, INC.
LUDINGTON, MICH.**

tives in Cut-Backs and Asphalt Cements". By Dr. Carlton H. Bascom, Technical Director, Kling Division, Lancaster Chemical Corp. Roads and Streets, March.

Adequate Bridge Maintenance Prevents Bridge Failures

All state bridge maintenance work is done by full time maintenance employees of the Mississippi State Highway Dept. Steel bridges are cleaned with a sand blast before repainting. Paint is applied with pneumatic spray guns and one coat of red lead is applied to the clean steel and two coats of aluminum paint are placed over the red lead. Paints are purchased under competitive bids. In concrete bridges, the only problem is the movement caused by expansion and contraction. Standard creosote timber bridges with the best creosote treatment, began to deteriorate at the center of the piles at about 12 years. Increased loads and heavy traffic have broken stringers and floor planks. Bridges are numbered running from zero at the west end of a route, extending in an east direction, and zero at the south end, running north. Reference and data files are kept on all bridges and an inspection is made of each bridge every year.

"Prevent Bridge Failures With Adequate Bridge Maintenance." By F. J. Russell, Engineer of Maintenance, Mississippi State Highway Dept. PUBLIC WORKS, April.

Effective Roadway Lighting Practice

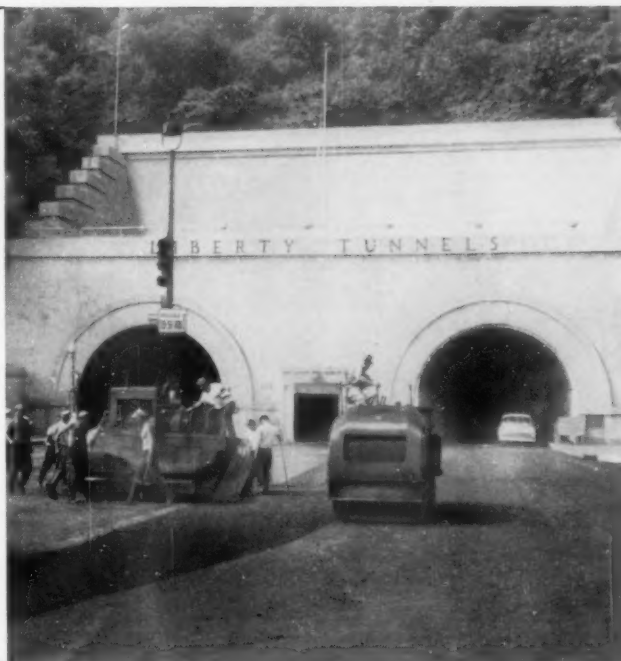
Total 1954 motor vehicle fatalities were 36,000. In urban areas it was 9,000 and in rural areas 27,000. Approximately 55 percent of the rural accidents occurred at night. With adequate visibility 50 percent of these night deaths, over 7,000, could have been prevented. We now invest between \$1.25 and \$1.50 annually per capita for roadway illumination and the needed amount lies between \$2.50 and \$4.00, if night traffic flow on our primary urban and inter-urban roadways is to be safe and comfortable. Chief benefits of roadway illumination include: 1) Traffic safety; 2) traffic comfort and convenience; 3) crime deterrent; 4) retail trade stimulation; 5) enhancement of property values and 6) promotion of civic pride, advertising value, and attraction of desirable residents. Three chief ingredients in effective roadway seeing are 1) Adequate pavement brightness, of satisfactory uniformity; 2) effective object and obstacle

Nationwide service on Bitumuls & Asphalt for every paving need...all from one source!

PENNSYLVANIA: Laykold® Asphaltic Concrete solves a tough paving problem on the Liberty Bridge, a major approach to downtown Pittsburgh. (When it comes to pavements, bridges are notoriously "bad actors" because expansion and contraction of the deck result in an unusual degree of movement under the surfacing). Based on previous use of Laykold Asphaltic Concrete, Department of Public Work officials for Allegheny County knew that this material retained an extra measure of resilience after placement and compaction, with no decrease in load-bearing value.

Mixed with slag aggregate, a 120 lb. "LAC" binder course and a 100 lb. "LAC" surface course were placed over an area of some 32,000 sq. yds. Trumbull Construction & Asphalt Company of Pittsburgh did the work. American Bitumuls & Asphalt Company supplied the asphalt and the Laykold Tempering Fluid.

Results to date: excellent service; no pavement failures.



CALIFORNIA: Across the nation, on the Pacific Coast, the State of California Department of Highways let a half-million-dollar contract for re-surfacing 41 miles of U. S. Highway 99 to the Schroeder Company, of Sun Valley, California. For this job, American Bitumuls & Asphalt Company supplied: 1,700 tons of Air Refined Asphalt; 3,500 tons of Paving Asphalt; 140,000 gallons of Bitumuls® Emulsified Asphalt.



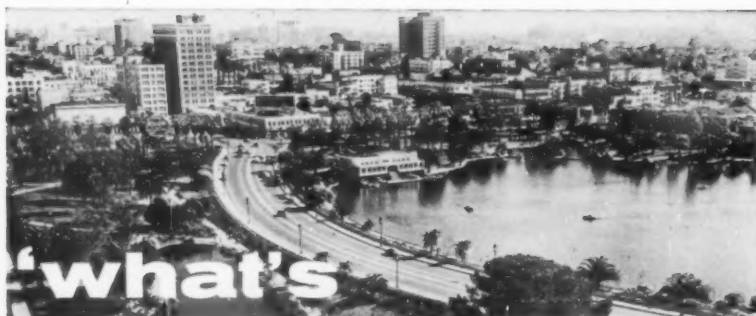
LOUISIANA: While "down South," on the construction of a road for private industry at Grand Isle, La., American Bitumuls & Asphalt Company supplied Bitumuls Emulsified Asphalt for 20,000 sq. yds. of 3-course surface treatment work on which *clam shells* were used as aggregate. As cover aggregate, shell produces a long-wearing surface.

Whenever . . . and wherever . . . your paving job calls for asphalt or asphaltic products, call our office nearest you. *That's your single source for all your asphalt requirements.*



American Bitumuls & Asphalt Company

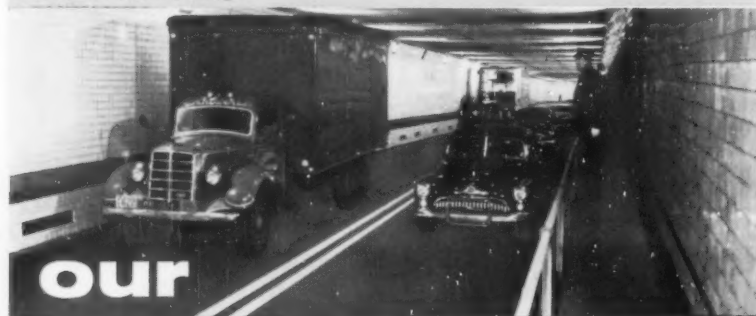
200 Bush St., San Francisco 20, Calif. Perth Amboy, N. J.
Baltimore 3, Md. St. Louis 17, Mo. Cincinnati 38, Ohio
Mobile, Ala. San Juan 23, P.R. Tucson, Ariz.
Inglewood, Calif. Oakland 1, Calif. Portland 7, Ore.



'what's

"Our painted crosswalks lasted approximately 4 weeks. PERMA-LINE crosswalks were still readily discernible after 16 months. The long life qualities of PERMA-LINE have materially aided our painting program ... released busy crews for operations in outlying areas ... resulted in substantial monetary savings."

Lloyd M. Broll
General Manager
Department of Traffic
Los Angeles, Cal.



our

"Recently, we installed permanent double white PERMA-LINE centerline markers in the Holland Tunnel to eliminate the need for repainting on a monthly basis."

Charles M. Taylor
Director of
Tunnels & Bridges
The Port of N. Y. Authority



line?'

"We have found it less expensive to install and maintain PERMA-LINE than any type of paint marking we could use. In addition, we have the valuable advantage in the central business district of less frequent interruption of traffic due to maintenance operations."

Karl A. Devins
Traffic Engineer
Atlanta, Georgia

SURE CURE FOR PAVEMENT MARKING HEADACHES

Modern Traffic Engineers the nation over count on guaranteed PERMA-LINE to expand their safety marking programs. PERMA-LINE meets today's demands for increased safety coverage, despite tight budgets and costly personnel.

REASON: PERMA-LINE outlasts old-fashioned marking methods 6 to 8 times, makes your present maintenance crews 6 to 8 times more effective.

PERMA-LINE ends installation traffic snarls because it is quickly and easily applied, sustains full traffic impact almost immediately, increases in brilliance with use, actually forms a bond with the pavement surface.

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brightness, which are positive factors; 3) subtractive luminaire glare, which is a negative factor. A reliable source of information for those dealing with roadway lighting problems is *American Standard Practice for Street and Highway Lighting*, issued by the IES Street and Highway Lighting Association, available at IES Headquarters, 1860 Broadway, New York, N. Y.

"Effective Roadway Lighting Practice". By R. M. Swetland. Illuminating Engineer, Outdoor Lighting Dept., General Electric Co., PUBLIC WORKS, April.

Overhead Signs Guide Drivers At Expressway Interchange

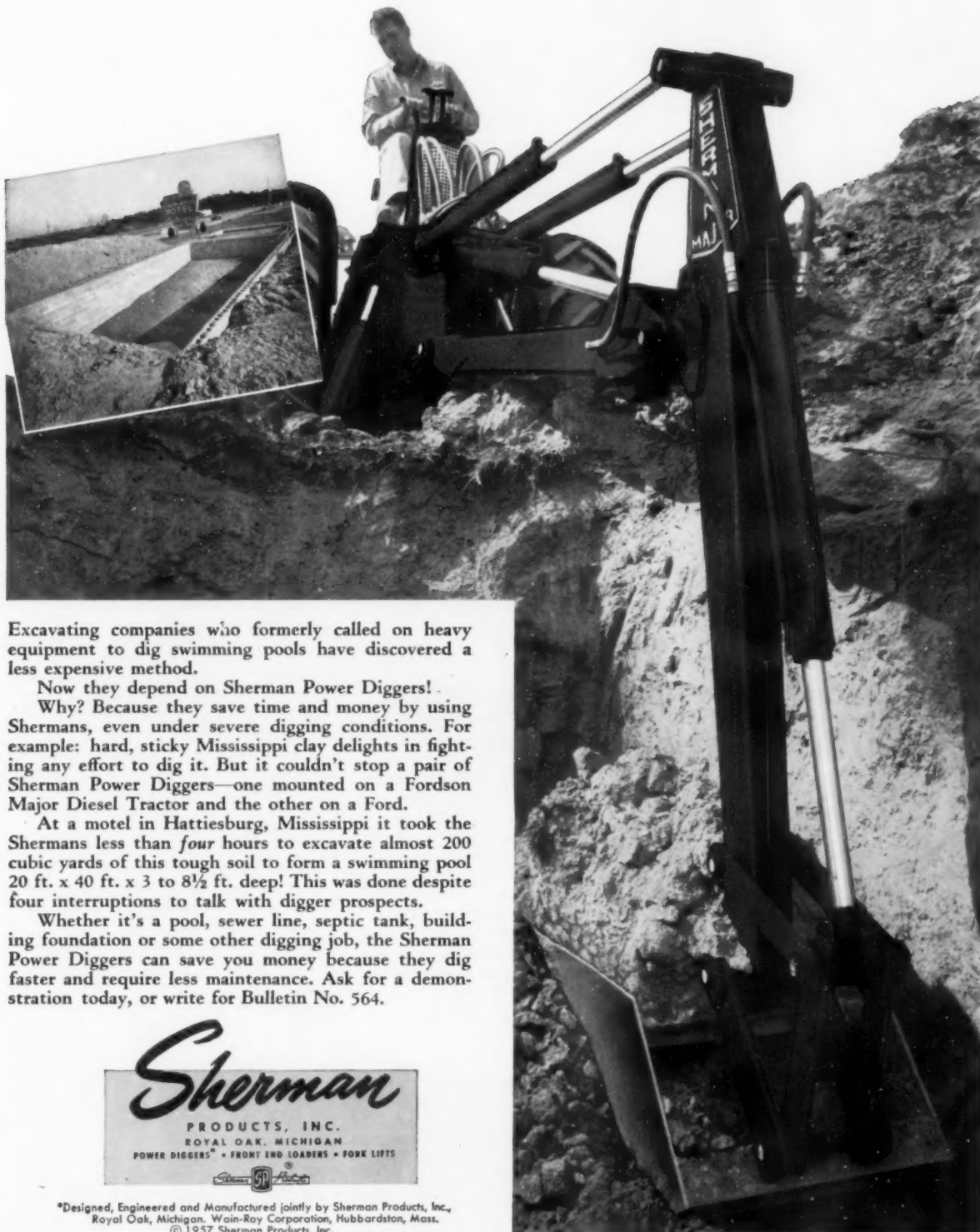
Internally lighted signs with faces and lettering made of translucent acrylic plastic were selected for complex directional signs for the busy interchange of New York State Thruway at Suffern, N. Y. Visual impact and legibility are practically uniform day and night on these signs. The acrylic plastic has excellent light transmitting and diffusing properties, possesses good dimensional stability and its weight is less than half that of glass. A total of 19 internally illuminated acrylic signs, mounted overhead at nine separate locations along the expressway or on access roads are installed at the Suffern interchange area. The faces are 3/16-in. thick sheets of translucent blue plastic, and the letters, which are cemented over cutouts in the face, are vacuum-formed from translucent white plastic. All signs are 4 ft. high and 11 in. deep and vary in length from 15 to 37 ft., depending on the legend and letter size. The assembled signs weigh about 7 lbs. per sq. ft. of face area.

"Overhead Signs Guide Drivers at Expressway Interchange." By Conrad H. Lang, Chief Engineer, New York State Thruway Authority. *Better Roads*, March.

Ohio Mechanizes Highway Design

Ohio has embarked on a system of mechanized highway design that is an inspired conception of new tools. The system takes the sciences of aerial surveying, photogrammetry and electronic computing and integrates them with new mechanical and electronic links to achieve substantially greater benefits than the sum of the parts. The Ohio method procedure is as follows: 1) Study available maps; 2) Fly at high level, usually 6600 ft. to take photographs; 3) From aerial photos at 800 ft. = 1 in. a stereoscopic viewer, the Kelsh

Digs swimming pool in less than 4 hours with Sherman Power Diggers



Excavating companies who formerly called on heavy equipment to dig swimming pools have discovered a less expensive method.

Now they depend on Sherman Power Diggers!

Why? Because they save time and money by using Shermans, even under severe digging conditions. For example: hard, sticky Mississippi clay delights in fighting any effort to dig it. But it couldn't stop a pair of Sherman Power Diggers—one mounted on a Fordson Major Diesel Tractor and the other on a Ford.

At a motel in Hattiesburg, Mississippi it took the Shermans less than *four* hours to excavate almost 200 cubic yards of this tough soil to form a swimming pool 20 ft. x 40 ft. x 3 to 8½ ft. deep! This was done despite four interruptions to talk with digger prospects.

Whether it's a pool, sewer line, septic tank, building foundation or some other digging job, the Sherman Power Diggers can save you money because they dig faster and require less maintenance. Ask for a demonstration today, or write for Bulletin No. 564.

Sherman
PRODUCTS, INC.
ROYAL OAK, MICHIGAN
POWER DIGGERS • FRONT END LOADERS • FORK LIFTS

*Designed, Engineered and Manufactured jointly by Sherman Products, Inc., Royal Oak, Michigan. Wain-Roy Corporation, Hubbardston, Mass.
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BARRIER-BEAM



Note these famous USF design features: (1) deep corrugations for high impact resistance, (2) broad surface area for maximum visibility, (3) exclusive rounded Safety Top edge, (4) convenient off-post splicing for faster erection. Use economically for highways, parking lots, parks, race tracks, bridges and approaches.



UNIVERSAL-BEAM



A new, specially-designed beam-type rail that lays either end to traffic and solves stock problems because it is completely interchangeable with similar parts of other manufacturers. 9-bolt connection with oval neck bolts assures maximum joint strength.

Both Barrier-Beam and Universal-Beam are available in either 10 or 12 gauge.

Write for more complete information.

UNITED STEEL FABRICATORS, INC.

PRODUCTS WOOSTER, OHIO

Hollow Metal Doors • Prefabricated Metal Buildings • Window Wells •
Highway Guard Rail • Bridge Flooring • Steel Forms for Concrete Bridge
Floors • Corrugated Metal Pipe • Sectional Plate Pipe and Pipe Arches

plotter, produces a 5-ft. contour strip at 200 ft. = 1 in.; 4) Actual centerline is then run on the ground; 5) Line is flown again at low level, normally 1650 ft.; 6) Transparent positive prints (diapositives) are produced from photos at 200 ft. = 1 in.; 7) With a horizontal measuring device added onto a Kelsh plotter, horizontal and vertical coordinates of points along cross sections are automatically punched into standard electronic computer punch cards; 8) A stack of cards with similar horizontal and vertical coordinates for points along design cross sections is obtained through a series of rapid-fire passes through the computer; 9) Earthwork volumes are obtained simply by running the terrain and design cards through the computer together; 10) Design and terrain cards are combined once again through several electronic mechanisms which automatically project individual cross-sections on an electron tube that looks like a small television screen; 11) Summaries of quantities that are normally included on contract drawings are run in a computer and reproduced; 12) Lastly, the same earthwork steps in the design procedure are utilized to determine pay quantities after the road is built.

"Ohio Mechanizes Highway Design". *Engineering News-Record*, March 14.

Factors Related To Urban Travel

This study was undertaken to determine the effect of automobile ownership, population density, distance from the central business district, and income per household on the number of vehicular trips residents made in Washington, D. C., on an average weekday in 1948. It was found that the use of all four variables combined did not produce a significant increase in the accuracy of predicting trips over that which was obtained using automobile ownership and population density combined. Furthermore, automobile ownership was found to be the most reliable single predictor with very little additional accuracy gained by combining it with population density. Preliminary results of an analysis of a 1955 followup traffic study strengthen the findings of the present study, as they apply to the relation between trips and automobile ownership per dwelling unit. The conclusion may be drawn that automobile ownership per dwelling unit is a good indicator for predicting the number of resident vehicular trips.

"A Study of Factors Related to



Heltzel Adjacent Curb Forms being set in place with a crew of two.

**Extra Quality plus
Extra Profit . . . that's what
HELTZEL FORMS mean to me!**

Says Leading Eastern Contractor



Heltzel Forms strip clean and easy cutting crew time to a minimum.



John Keelor, head of Keelor Construction Co., going over job blueprints with G. L. Finnen, Resident Engineer, and E. R. Hummell, District Construction Engineer.

"I've used all the popular makes of steel forms in my years in the construction business and I find the **Extra Quality** built into Heltzel Forms means **Extra Profits** right down the line," says John Keelor, head of the Keelor Construction Company, Pennsburg, Pa., one of the east's leading construction firms. "Heltzel Forms are designed right, to go down fast and strip easy with a minimum crew. The stake pockets are situated

where they should be to give maximum support without bowing. And, Heltzel Forms can take the punishment of everyday use without failing."

When next you're in the market for steel forms for any purpose, remember it costs no more to have the finest. Specify Heltzel Steel Forms and get the **Extra Quality** that means **Extra Profits**.



THE HELTZEL STEEL FORM & IRON COMPANY

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411 THOMAS ROAD

WARREN, OHIO

PUBLIC WORKS for May, 1957

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Urban Travel". By William L. Mertz, Highway Transport Research Engineer and Lamelle B. Hamner, Statistical Assistant, Bureau of Public Roads. *Public Roads*, April.

Are We Cluttering Our Air Waves?

In Walla Walla County, Washington, the installation of mobile radio units was rather costly, however they have completely paid for themselves many times over in hours saved and emergencies met. Because of their application, a more uniform management has been made possible

throughout the entire year. Due to the number of other departments using radios, the highway department converted their equipment to an assigned frequency of 33.06 mc. Because of atmospheric conditions and space phenomena such as sun spots, radio interference has been particularly bad during the winter of 1956-1957. Also, interference from other sources that were assigned the same frequency has occurred. Too many highway departments have assigned radio units to too many highway vehicles. Too much radio time is taken for un-

necessary conversation and giving orders. More consideration of the use of radio must be used if the greatest benefit is to be derived from the unit.

"Are We Cluttering Our Air Waves". By B. Loyal Smith, County Engineer, Walla Walla County, Wash. *Better Roads*, March.

Mudjacking Operations in Highway Maintenance

Mudjacking consists of raising depressed sections of concrete pavements, curb and gutter, and sidewalk to their respective original levels, or to a satisfactory level, by means of pumping prepared mud or slurry under the affected areas. Equipment used for mudjacking in the state of Michigan consists of a 5-ton flat-bed truck, which has an R-522 Chausse cement mixer powered by a 4-cylinder LeRoi gasoline engine; a Joy air compressor of 105 cubic feet capacity; a pressure chamber; other miscellaneous tools; and hoses. A 500-gallon water tank is towed with the equipment to provide a daily supply of water. The slurry consists of 6 parts sand, 1 to 2 parts lime and 1/2 to 1 part cement. The exact proportions of the mix and amount of water added depends upon the experience and judgment of the mudjack operator. A foreman and a crew of 7 men are used in the mudjacking operation.

"Mudjacking Operations in Highway Maintenance". By H. H. Cooper, District #7 Maintenance Engineer, Michigan State Highway Dept., Kalamazoo, Mich. *PUBLIC WORKS*, April.

Urban Renewal and Your City's Arterial Route Planning Job

Because proposed routes are bound to have major impact on the entire community and the way its people live, an urban renewal program can serve to speed construction of highways in and around cities under the accelerated highway program. Few communities are really prepared to meet the growing problems of the highway program. Relocations are inevitable and the people affected must be adequately rehoused before land clearance can be undertaken. The problem of relocation for business establishments will require the establishment of organized programs of assistance. City after city has found it essential to stimulate the formation of official or unofficial citizens' organizations, to study and help explain the reasons for renewal projects, to participate in the development of plans for them to support the necessary

NEW DESIGN! NEW EFFICIENCY!



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MODEL 424-56 PRESSURE DISTRIBUTOR

New power, New pump, All new features—as follows: A new "Econo-bar" spray bar in addition to the famous Standard Steel "Miracle" spray bar. New hydraulic spray bar lift. More convenient, easier to operate controls. Shorter, simplified piping to reduce heat bleed-off.

The Model 424-56 is built in 1000, 1250 and 1500 gallon capacities as standard and can be furnished in other capacities, either truck or semi-trailer mounted.

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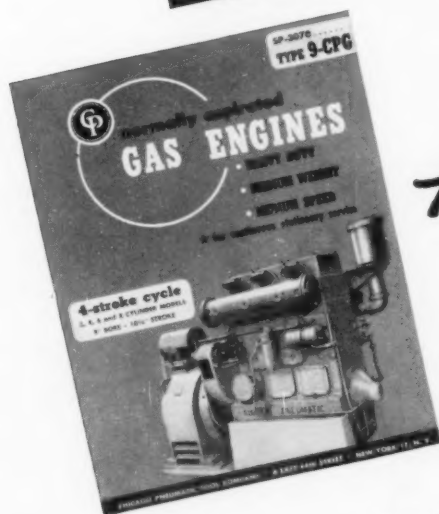
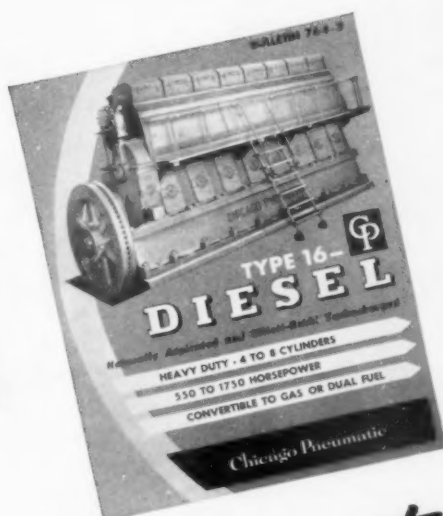
Standard Steel Works, Inc. NORTH KANSAS CITY, MO.

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PUBLIC WORKS for May, 1957



BANTAM METHOD

saves time—manpower—money

This series of "manhole" excavations in Milwaukee is a good example. After concrete is broken up with air hammer, the BANTAM Crawler with clamshell digs spot excavations and loads material into trucks. Excavations are shored up to prevent cave-ins. Here, BANTAM's precise control of clamshell bucket makes a fast, safe operation of it. And there's no interruption of traffic on this busy street.

Because BANTAMS work with nine different quick-change attachments, they move in and handle dozens of jobs for less money than other rigs. With the BANTAM Method you can cut costs on projects like street repairs, sewer installations, utility lines, sanitary landfills, water purification systems, sewage beds, loading materials in supply yards, and many others. And handle them all with this *one basic tool!*

That's why BANTAM is first choice among Public Works Departments. Use the handy coupon to request literature.

World's largest producer
of truck cranes
and excavators



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use of public powers and public expenditures on the part of the municipality.

"Urban Renewal and Your City's Arterial Route Planning Job." By L. Perry Cookingham, City Manager, Kansas City, Mo. *Street Engineering*, February.

Other Articles

"Prestressed Concrete Bridges by Freyssinet System" by fundamental design principles. By M. Yves Guyon, Chief Engineer of S.T.U.P., Paris. *Contractors Record and Municipal Engineering*, February 13.

"All-Welded Aluminum Construction For South Wales Footbridge" is of 60-ft. span and 4-ft. 6-in. wide footway. *Highways and Bridges and Engineering Works*, February 13.

"Two Bases for the Biggest Strategic Bombers." The bases are the Loring Air Force Base, Limestone, Maine, and the Portsmouth Air Force Base, Portsmouth, N. H. *Engineering News-Record*, February 28.

"Surveying With Plane and Camera." By William O. Baker, Michael Baker, Jr., Inc., Consulting Engineers. *Consulting Engineer*, March.

"Seeding of Golf Course in City Do-It-Yourself Job Proves Practical, Economical". By George F. Burnley. *Public Works*, April.

"Getting 10,000 Parking Spaces For Coral Gables" was obtained by the issuance of \$1,000,000 worth of revenue certificates, redeemable from proceeds of parking meters and backed also by the franchise tax money, received by the City from the Florida Power & Light Co. By C. E. Wright. *Public Works*, April.

"North Carolina Measures Roughness of Roads" by the use of a *road roughness indicator*. By C. E. Proudley, Chief Materials Engineer, North Carolina State Highway and Public Works Commission. *Public Works*, April.

"Highway Planning For the Small City, the Traffic Story—How Many Cars?" By Jacob Mende. *Public Works*, April.

"Aerial Photography" *saves time and money* and helps expedite public works planning in Birmingham. By Alton L. McWhorter, City Engineer, Birmingham, Ala. *American City*, March.

"A Bargain In Grading", By R. D. Evans, Staff Consultant, Sales Development, Caterpillar Tractor Co. *Civil Engineering*, March.

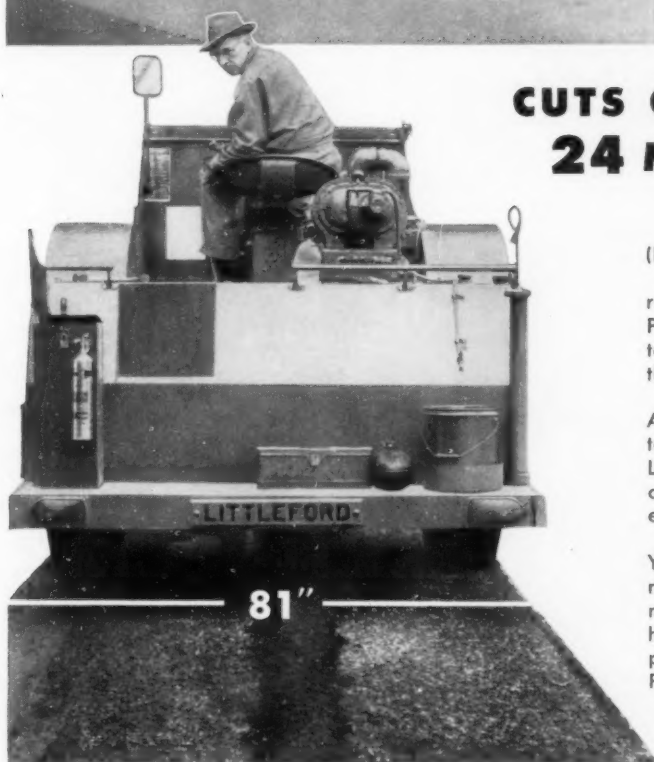
"U. of Wisconsin Sponsors Institute on Report Writing". By Richard A. Garver. *American Engineer*, March.

"County Board **Must Recognize Importance of Road Program**". Failure of county board to assume its responsibilities in providing an efficient highway department probably will result in more and more centralization in state and federal governments. By Victor H. Hulstrand, County Commissioner, St. Louis County, Minn. *Better Roads*, March.

A & A Asphalt Paving Co. set the astonishing record detailed below . . . on Detroit's busy streets, without interrupting traffic!



LITTLEFORD-CLARKMOORE HEATER PLANER



Heats and planes 81" wide path all in one continuous operation. Windrows material behind for easy pick up.



world's most complete line of completely engineered black top equipment

CUTS CONTRACT TIME FROM 24 MONTHS TO 33 DAYS!

"1,500 square yards planed per day."

"2 1/2 miles of black top planed off Gratiot Avenue (Detroit) in 14 days."

"Records like that—impossible before, but now routine with the new Littleford-Clarkmoore Heater Planer—helped us complete in 33 days a road maintenance contract that would have taken 24 months the old way!"

That's the record established last fall by A & A Asphalt Paving Co., Birmingham, Michigan, according to Reno Ministrelli, President. The efficiency of the Littleford-Clarkmoore Heater Planer also enabled the company to reduce its crew from 125 to 14, and equipment from 25 trucks to 4.

Equally astonishing records are being set in New York City, Birmingham, Ala., Chattanooga, Tenn., Harrisburg, Pa. . . . by contractors and highway departments. For a better understanding of what this modern, high-speed Littleford-Clarkmoore street and highway planing can mean to you, send for your free Heater Planer Portfolio. Littleford Bros., Inc., Dept. LB 257—

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New Features THAT MEAN GREATER PROFITS TO CONTRACTORS

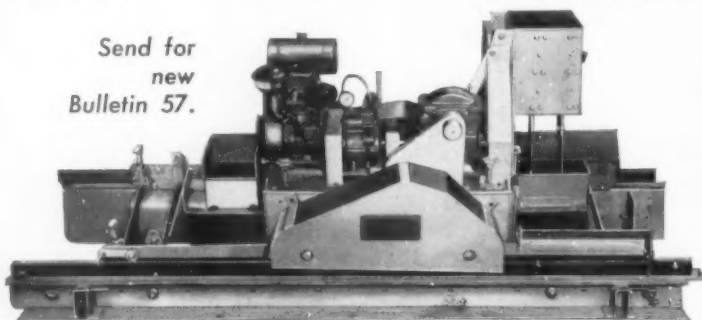
VIBRATOR on rear hopper assures smooth traveling — no dragging or tearing. Air supplied by compressor and tank on machinery deck.

New TRANSMISSION provides smoother operation — convenient lever for Neutral, Forward and Reverse. Power Grip Timing Belt between engine and transmission.

Dotmar CURB AND GUTTER PAVER

MECHANICAL TAMPER in front hopper eliminates hand tamping and spading. Three men and a Dotmar can lay up to 10 lineal feet per minute. Lays sidewalk too. Pays for itself in first mile of paving.

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Ask about Porta-Mixer, the hydraulic loader-mixer for tractor shovels.

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WHEN you're specifying — don't start until you have this new Crispin Air Valve Catalog in your hands! Its 28-pages give detailed information on all Crispin service-engineered products that, for over 45 years, have provided safe, precise control of air in pipelines.

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CONCRETE for SEWAGE WORKS

E. C. WENGER

Presented at the American Concrete Institute 53rd Annual Convention, Dallas, Texas, February, 1957.

CONCRETE is, of course, an essential material for the construction of sewers and sewage treatment plants. The corrosion of concrete in sewage works, while admittedly a serious problem where it occurs, is actually a rare occurrence as evidenced by the many miles of concrete sewers and the large number of disposal plants that have been in satisfactory use for many years.

Corrosion of concrete in sewage works, where it occurs, is dependent on a combination of certain physical, chemical, and biological conditions which result in a complex chain reaction. Some of the possible sources of corrosion of concrete are: Strong acid wastes are objectionable not only because they will corrode concrete, but also other materials, such as steel and iron. Where acid wastes of pH of less than 5.5 are to be continuously discharged into a sewer, concrete should not be used without a protective lining or coating. However, an occasional discharge of acid whether accidental or planned of short duration will not appreciably affect the life of a quality concrete sewer structure.

Another possible source of corrosion in sewers is that occurring indirectly from hydrogen sulfide generation. Hydrogen sulfide itself will not corrode concrete. However, after it is evolved as a gas into the sewer atmosphere, it may be oxidized by aerobic bacteria on the walls of the sewer above the flowing sewage to form droplets of sulfuric acid, which cause corrosion.

Design Controls H₂S

In most instances hydrogen sulfide can be controlled in the design of sewers by eliminating one or more of the several factors which must be present for its generation. In a gravity sewer, if sufficient oxygen is absorbed by the flowing sewage, there will be no sulfide built up. The amount of oxygen required depends upon the strength of the sewage and its temperature. The rate in which oxygen can be absorbed by a flowing stream depends upon its velocity. Experience has shown that where velocities in gravity

sewers were provided to meet usual design requirements, there has been no significant amount of corrosion resulting from the oxidation of hydrogen sulfide to sulphuric acid.

In a force main carrying sewage, no surface area is available for oxygen absorption. Consequently, there will be a buildup of dissolved sulfides, even if the sewage is weak. Since the pipe is flowing full, no evolution of the gas is possible, and consequently, no corrosion will occur in the force main. However, at the end of the force main, if it discharges into a gravity sewer, hydrogen sulfide will be liberated and corrosion of the sewer structure at that point, and for some distance downstream will likely occur. To prevent such corrosion several things may be done: ammonia may be injected into the sewer atmosphere to neutralize the sulfuric acid as it forms on the walls of the sewer; the generation of hydrogen sulfide can be inhibited by use of chemicals at the pump sump; or oxygen may be added by injecting compressed air at the pump discharge. The amount of air required will depend upon the amount of sulfide generated in the force main, which can be calculated knowing the strength and temperature of the sewage, and the inside surface area of the pipe.

Special Conditions

Where conditions are such that the design requirements, mentioned above, can not be met, other economic means can be taken, such as: (1) use of chemicals to inhibit certain reactions; (2) use of compressed air to keep sewage fresh; (3) periodic cleaning of sewers to remove slime and prevent obstructions from reducing velocity; and (4) use of acid resisting liners in the concrete structure.

The concrete in sewage treatment plant structures is generally subjected to severe exposures of repeated cycles of freezing and thawing, and wetting and drying. Therefore, it is essential that the concrete be of the highest quality. To attain this quality it is mandatory that the basic principles of concrete making be rigidly adhered to. These are: (1) The use of sound, well-graded aggregates; (2) low water-cement ratio; (3) properly designed mix; (4) careful placement; and (5) adequate curing.

To these requirements should be added air-entrainment.

Air-entrained concrete was developed originally to improve the resistance of concrete to surface

scaling resulting from application of salts for ice removal. It has served this purpose very well. In addition, it has been found that air-entrained concrete has many other beneficial properties that are particularly desirable in concrete for sewage treatment works. These are: (1) Increased resistance to freezing and thawing, and wetting and drying; (2) increased workability and cohesiveness; (3) reduced segregation and bleeding; and (4) reduced permeability and an increased resistance to sulfate waters.

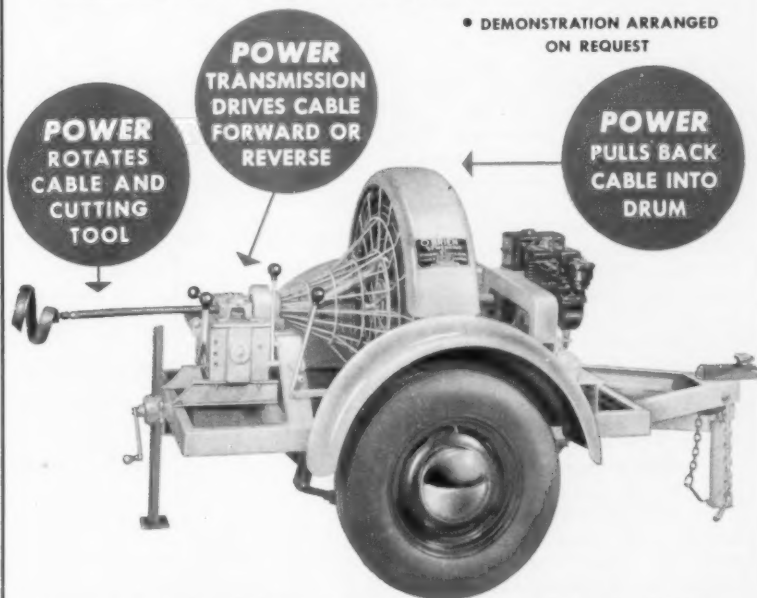
The use of air-entrained concrete should also have considerable merit

in sewer conduits, even though these are not generally exposed to freezing and thawing. The reduction in permeability and improved resistance to sulfate attack should amply justify the use of air-entrainment wherever possible in sewer conduit construction.

Since the concrete in sewage works is subject to severe exposure, it is essential that it be of the highest quality. While no portland cement concrete is immune to strong acid attack, nevertheless the higher the quality of the concrete, the greater its resistance to such attacks.

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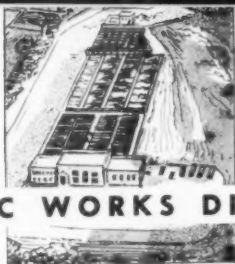
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Designing for Institutional Plants

Sewage flows from institutions follow definite patterns depending on inmate routines, but are generally greater than from municipalities. Large variations occur, necessitating special considerations in designing plants. Institutions in New York are rated on the basis of certified capacity, a specified floor area per individual housed. The operating staff must also be taken into consideration. To compensate for variations and uncertainties in sewage flow, to avoid inadequate detention periods in small units during peak flows and otherwise to furnish a factor of safety, an "equivalent capacity factor" is used. It is the sum of coefficients based on patient loading and staff loading and is used as a multiplier for arriving at an equivalent population. The certified capacity is multiplied by the equivalent capacity factor, which product is added to the certified capacity to obtain the design population. The average flow assumed is the product of the design population and the average gpcd based on experience or New York State Dept. of Public Works standard criteria.

"Sewage Flow Considerations in Institutional Treatment Plant Design." By J. C. Federick, New York State Dept. of Public Works. PUBLIC WORKS, April.

Raw Sewage Lagoon Research

A research project undertaken jointly by the California State Water Pollution Control Board and the University of Southern California concerned reclamation of a raw sewage lagoon effluent at Mojave, Calif. Having the purpose of providing a Marine air base with irrigation water and demonstrating the adequacy of treatment afforded in a raw sewage lagoon, the studies involved the use of two 46-ft. by 143-ft. basins and one 143-ft. by 175-ft. "primary" lagoon. The latter received raw sewage and was of adequate depth to assure adequate mixing and diffusion. The

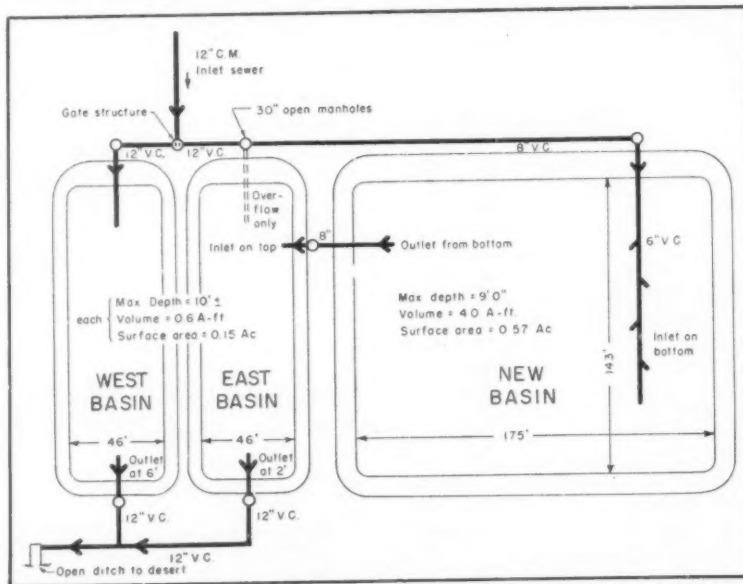
east basin, one of the smaller ones, is normally operated in series with the primary lagoon. The sewage, from a population of 4,000 is domestic in character, with a flow of 0.2 mgd. Flow was measured, temperatures were recorded, and flow patterns were observed, using florescein. Laboratory investigations included BOD and solids measurement and analyses for plankton and bacteria, including plate counts and MPN of coliform organisms. Various BOD loadings were attempted in the primary basin. Results of the plate counts indicated that a reduction in organisms occurs in the primary lagoon, with the secondary lagoon having little effect. While time has not permitted full evaluation of the results, it would appear that basins designed similar to the new basin and used in similar locations should provide average BOD removals of 60 percent and soluble BOD removals of 85 percent under continuous loadings upwards of 100 lb. of BOD per acre per day. It is further concluded that the selected depth of approximately 9 ft. made possible desirable influent mixing

and diffusion, and that a detention time of less than one month, resulting in percolation and evaporation losses less than 20 percent of the sewage flow, makes this system particularly suitable for waste water reclamation.

"Investigation of Primary Lagoon Treatment at Mojave, California." By R. C. Merz, J. C. Merrell, and Ralph Stone, University of Southern California. *Sewage and Industrial Wastes*, February.

Pure Oxygen Speeds Biological Treatment

As a result of successful laboratory-scale investigations on the use of pure oxygen to improve the economic efficiency of activated sludge treatment, a pilot plant was installed at the Back River Sewage Treatment Plant in Baltimore, Md. to evaluate methods more fully. The pilot plant was designed for a constant flow range between 10 and 30 gpm and consisted of a 4-ft. diameter by 12-ft. depth flow unit, with six 13.5-ft. long tapered tubes connected in parallel and used as oxygenation units. While data obtained



Courtesy Sewage & Industrial Wastes

● SCHEMATIC diagram for raw sewage lagoon treatment installation at Mojave.

Largest floating cover digester installation on the West Coast—San Francisco's North Point Sludge Treatment Plant



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There are two batteries of five digesters, and a control building for each group. All ten digesters are equipped with 100' diameter P.F.T. Floating Covers for positive scum submergence and safe utilization of gas. The snug-fitting P.F.T. covers eliminate odor problems—an important consideration in this installation because of a residential area close-by. Gas collected under the domes is maintained at constant pressure under all operating conditions, greatly reducing explosion

hazards. Capacity is highly flexible, because no fixed levels need be maintained; covers simply rise or lower with additions and withdrawals.

Housed in the control buildings are a total of eight P.F.T. #1500 Digester Heaters and Heat Exchangers, equipped with automatic controls. These heaters—using sludge

gas as fuel—maintain constant digester temperatures, and also heat the control buildings. Rated heater output capacity is 12,000,000 B.t.u./Hr. Other P.F.T. equipment at this plant includes P.F.T. Floating Cover Position Indicators, and a full complement of P.F.T. Gas Safety Equipment.

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with this pilot plant established basic conditions of design, low oxygen absorption efficiencies showed the need for further studies. A second pilot plant was constructed at Stamford, Conn., to handle a flow range of 50 to 75 gpm. A 12-ft. diameter steel tank, 22.5 ft. deep was equipped with a mechanism having four submerged rotating arms at the bottom of the tank. The flow patterns consisted of (a) pumping clarifier effluent through the oxygen absorption column and thence to the upflow unit utilizing a sludge blanket or (b) pumping clarifier effluent through the sludge blanket

with recirculation through the oxygen absorption unit. The treatment steps associated with conventional activated sludge practice were accomplished with oxygenation of settled sewage prior to entry into the upflow treatment unit. The efficiency of BOD removal was found to be a function of the overflow rate, the optimum being 900 gal. per sq. ft. per day. In comparison with conventional activated sludge treatment, the process investigated showed that secondary treatment area requirements may be reduced as much as 50 percent and volume requirements 30 per-

cent. Power requirements appear to be about the same. The upflow unit serves as both aerator and final clarifier.

"High-Purity Oxygen in Biological Sewage Treatment." By W. E. Budd and G. F. Lambeth, Dorr-Oliver, Inc., Stamford, Conn. *Sewage and Industrial Wastes*, March.

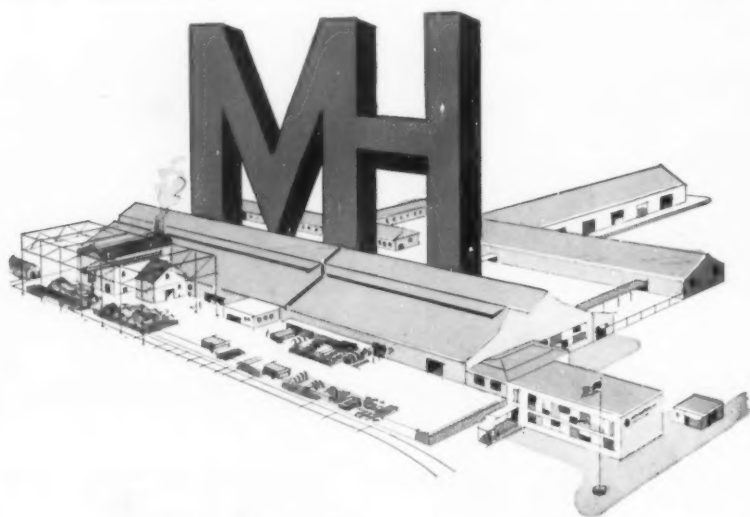
Township Foresees Sewerage Problems

To circumvent the usual problems associated with rapid residential and industrial development and the proneness to use septic tank sewage disposal, Wayne Township in Passaic County, N. J., employed an engineering firm to develop a sewerage system for the 28-sq. mile Township area. The design started with three contiguous real estate developments and a new high school, and agreements were obtained with representatives of the developments to provide for the construction of a trunk sewer and sewage treatment plant. Design calculations were based on the eventual residential population of the area of 1,460 contributing 250 gpcd and a school of 650 contributing 20 gpcd. Developers supplied lateral sewers. The plant consists of a bar rack, grit chamber, comminutor, a primary settling tank, two aerator clarifiers and a chlorinator. Velocity through the grit chamber is controlled by a Kennison nozzle. Sludge digestion is provided in an unheated tank, designed on the basis of 6.2 cu. ft. per capita, and sludge disposal is by means of drying beds. The agreement with the developers provided for financial contributions toward construction and operating costs of the system in proportion to respective usage. Funds were placed in escrow, and further stipulations stated that operating costs would be met by a sewerage service charge levied against each property owner, collected by the Township.

"Dollar-Saving Sewerage Service." By Alfred Crew, Consulting Engineer, Ridgewood, N. J. *American City*, March.

Enlarging the Hyperion Plant

When the work of a Citizen's Committee is completed, the Los Angeles sewers and sewage disposal facilities will be increased in capacity from 245 mgd to 420 mgd. The basic plan is to modify the treatment provided at Hyperion such that an average flow of 300 mgd of sewage will receive sedimentation only and be discharged to sea. Another 120 mgd will re-



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ceive conventional activated sludge treatment in the existing facilities and then be discharged to sea or reclaimed as industrial water or by recharging ground water. Oceanographic studies are underway to determine factors that will have a bearing on the design of the outfall for sewage effluent and the ocean outfall for digested sludge. The improvements will include facilities for pumping digested sludge to sea, new headworks building to house screening equipment, new grit removal facilities and new sedimentation basins. An interchange structure has been designed which provides a

choice of flow diversion to the new or existing treatment facilities; its primary function is to separate saline and non-saline waters. A tubular conveyor, using articulated flights, removes grit accumulations in the preaeration tanks. Negotiations are underway to sell excess digester gas to the Los Angeles Department of Water and Power, which has a nearby steam turbine plant under construction. The new grit removal facilities will be of the aerated tank type, with tubular conveyors for transfer to overhead storage and truck disposal. As a result of investigations aimed at

odor control, the ventilation air from covered treatment structures will be used as makeup air for the blowers supplying air to the activated sludge tanks.

"Enlarged Sewage Disposal Facilities for Los Angeles." By Robert J. Theroux. *Sewage and Industrial Wastes*, February.

Las Vegas "Strip" Sewage Plant

The new sewage plant being constructed for the Clark Co. Sanitation District No. 1 at Las Vegas will serve 4000 acres of the south boundary of Las Vegas which includes "The Strip," site of famous hotels and gambling houses. Providing for a flow of 12 mgd, the plant consists of a mechanically-raked bar screen, grit removal and washing units, a primary clarifier, two high-rate trickling filters with recirculation, secondary clarifiers, chlorination, and two-stage digesters. Sludge disposal will be effected through drying beds. The plant utilizes a flow-measuring transmitter and a Palmer Bowlus flume. The primary digester cover is equipped with a Pearth Gas Recirculation System for scum control. The piping and controls for the digestion units were designed for maximum flexibility, permitting simultaneous transfer of sludge or liquor from the primary to the secondary digester and recirculation of liquor from the primary digester through the heater.

"Las Vegas 'Strip' Area Does Not Gamble With Sewage Treatment." By Perliter and Soring, Consulting Engineers, Los Angeles. *Wastes Engineering*, March.

Controlling Aerator Foaming

Foam or froth in aeration tanks, which can mar the appearances of buildings, roads, walks, etc., create dangerous slippery conditions, cause obnoxious odors and create adverse publicity, can be controlled by several means. These are: (1) Raise the suspended solids level carried in the aerator; (2) use water sprays to kill the foam; (3) use defoamants to kill the foam; and (4) utilize any combination of two of the above or possibly all. An efficient defoamant should possess the following desirable characteristics: Be a liquid; have good foam knockdown and residual effect or persistency of this knockdown quality; have lower specific gravity than water, constant or nearly constant viscosity over the range of the outdoor temperatures encountered, water insol-



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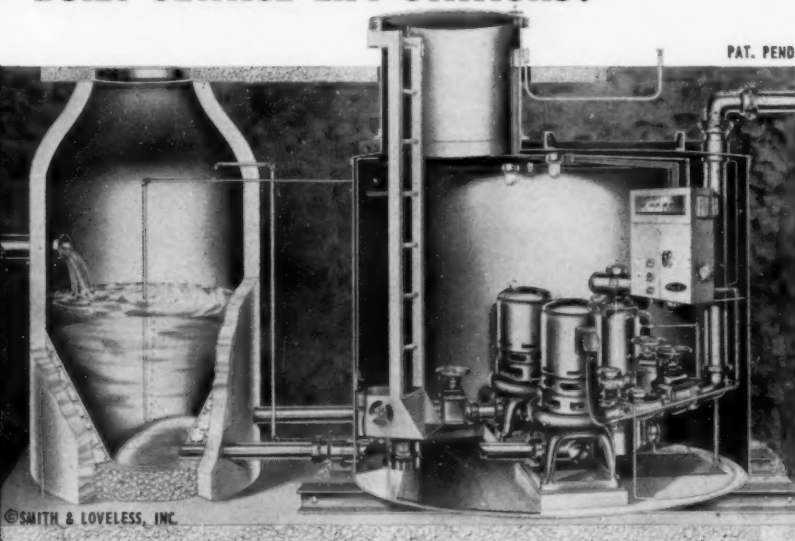
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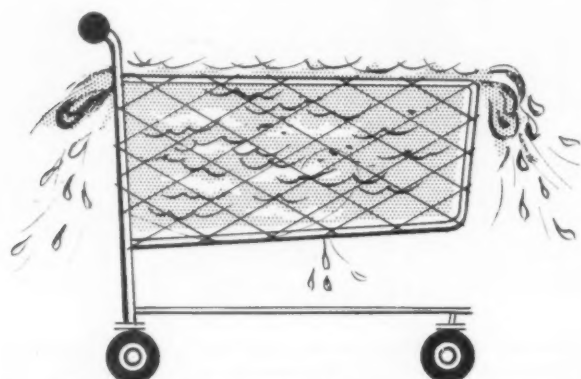
"Aerator Foaming Can Be Controlled." By A. E. Sparr, Supt., Bay Park Sewage Treatment Works, East Rockaway, New York. PUBLIC WORKS, April.

Heat Pump for Digester Heating

Several problems were encountered in the design of sewage treatment facilities for a suburban area south of Seattle along Puget Sound. The terrain is rough, broken by numerous ravines, and the residential character prohibited unsightly and nuisance creating structures. While two plants will eventually be needed to serve the area, because of topographic conditions, the plant was designed on the basis of temporarily pumping sewage from the Miller Creek drainage area to the Salmon Creek drainage area. Using

design figures of 15 persons per acre for saturated population and 66 percent of saturated population by 1970, a design population of 35,000 was assumed adequate until sometime between 1970 and 1980. Extensive landscaping would have to be provided to break up extensive areas of clarifiers and sludge beds could not be permitted. Vacuum filtration of sludge with flash drying appeared to be the answer to the sludge disposal problem. The plant will consist of a combination grit removal and pre-aeration unit, a comminutor, Catalytic Reduction Process equipment, a sludge thickener, an automatic chlorinator, and a sludge filter with a flash dryer to be added later. Since there would not be sufficient gas produced to operate the flash dryer and heat the digester, a heat pump is to be provided to heat the digester and the gas holder. To conserve digester heat, the digestion tank was insulated. The heat pump consists of a condenser, shell and tube chiller, a compressor, and pumping equipment to pump sewage effluent through the chiller.

"Sludge from Heat Pump-Heater Digesters May Be Flash-Dried." By Mervin A. Minish, Hill & Ingman, Consulting Engineers. *Wastes Engineering*, March.



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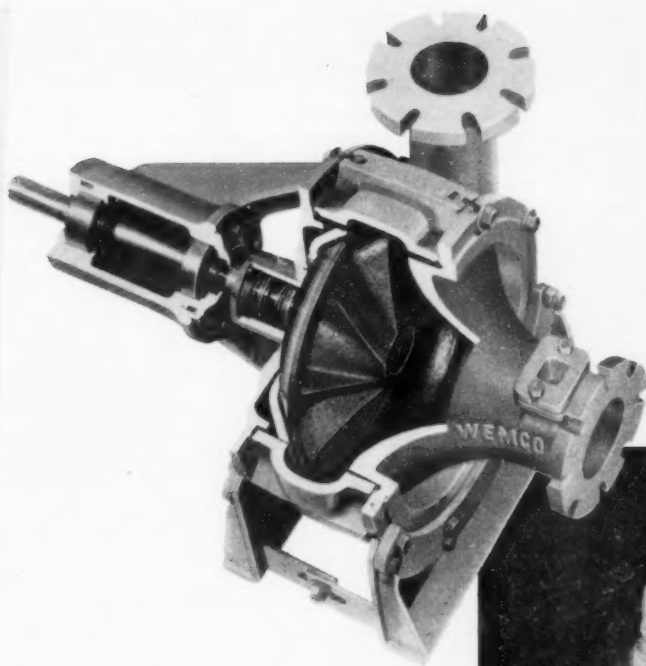
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Tenets for Water Pollution Control Authorities

The state regulatory agency serves as an umpire in a situation of conflicting interests: users of public water supplies, public waste disposal agencies, industrial water users, industrial establishments seeking to dispose of wastes, recreational groups, power interests, shipping interests and agriculturists. Disease implications are not out of the picture, even though modern water and sewage treatment has accomplished wonders. A water treatment plant can still be overloaded from a polluted stream, and sewage treatment has been known to fail. Florida has never adopted a stream classification plan because of the great divergence of interests. The present endeavor involves informal classifications and sets stream standards which would protect major interests and leave the door open to upward classification at a later date. The role of the state water pollution control authority is to advise, counsel, recommend, and suggest requirements for safe discharge of sanitary and industrial wastes into the surface or underground water supplies. The deciding factor, in each case, is the highest use for



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which the waters are to be used. Only as a last resort should recourse be taken to legal measures. Water pollution control should be a co-operative enterprise between good neighbors. The law is needed only for the occasional stream bandit who would steal all of the resources for himself without regard to the needs and rights of others. The water pollution control authority should be an impartial arbitrator for the rare serious disagreements in which even good neighbors can sometimes become embroiled.

"The Role of the State Water Pollution Control Authority." By David B. Lee, Florida State Board of Health. *Sewage and Industrial Wastes*, February.

Testing Joints for Root Penetration

Tests were undertaken in 1948 at the Back River sewage treatment works at Baltimore to observe the effectiveness of various types of sewer pipe joints in preventing root penetration. Three 6-in. terracotta lines were laid horizontally 18 ins. below the ground surface three feet apart and parallel. Lombardy Poplars were planted between and adjacent to the lines. The jointing ma-

terials tested included clay and salt, cement, CPI-2 bitumastic compound, copper, G-K primer and compound and G-K compound. The pipe sections were kept filled with water to encourage root growth. In August, 1956, examination of the interiors was made. Of the six clay and salt joints, all but one had permitted root penetration, while all of the other types allowed comparatively none. It was concluded that this type of joint is not to be recommended.

"A Study of the Resistance of Sewer Pipe Jointing Material to the Entry of Tree Roots." By C. E. Keefer, Assistant Bureau Engineer, Bureau of Sewers, Baltimore, Md. *Water and Sewage Works*, March.

Aluminum Distributor For Trickling Filters

The new sewage treatment plant for Dayton, Iowa, was built on a site one-quarter mile downstream from the existing plant, and to avoid some 30-ft. cuts, portions of the outfall were constructed along a railroad right-of-way. Treatment facilities included an Imhoff tank with a 2.5-hour retention period and 3.5 cu. ft. per capita in the digestion chamber, a 52-ft. diam. stand-

ard trickling filter and a final settling tank with retention time of 1.5 hours. The rotary distributor selected for the trickling filter is the Gravity Actuated Rotary Distributor, developed by the General Filter Co. The distributor is of aluminum and does not require the actuating head normally indicated. The Dayton unit was designed for a maximum rate of 85 gpm and a minimum of 30 gpm.

"The New Sewage Treatment Works of Dayton, Iowa." By Neil A. Carpenter, Ames Engineering Testing Service, Ames, Iowa. *Water and Sewage Works*, March.

Other Articles

"Vertical Dry-Pit Sewage Pumps." By R. H. Deurer, Worthington Corp. *Public Works*, April.

"Incinerator Will Solve Many Refuse Problems." By Phil Hirsch. *Public Works*, April.

"Experiences With Subdivision Regulation." By J. A. Salvato, Jr., Rensselaer Co. Health Dept., Troy, New York. *Public Works*, April.

"Sewage Lagoons for the Treatment of Raw Municipal Wastes." By R. L. Smith and H. C. Leabee, Consulting Engineers, St. Paul, Minn. *Public Works*, April.

"Activity of Cellulose-Decomposing Fungi Isolated from Sewage Polluted



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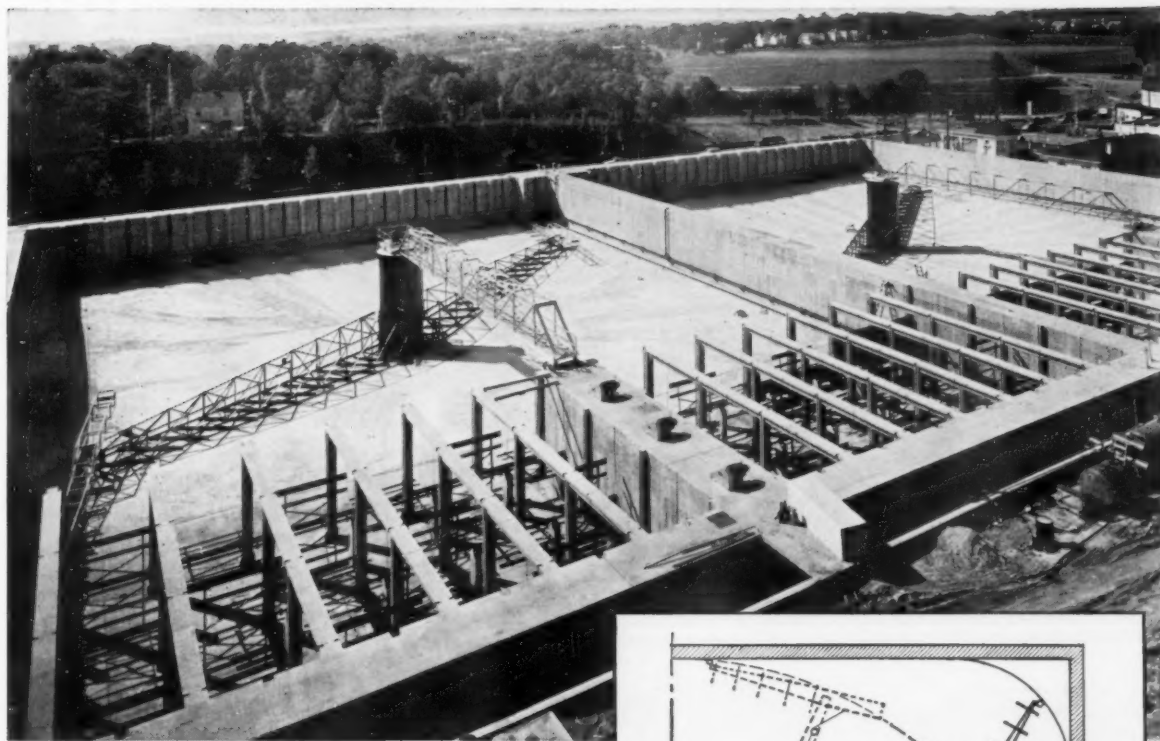


Keep operating costs down with
ENTERPRISE
dependable engines



ENTERPRISE ENGINE & MACHINERY CO.
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LINK-BELT supplies Baltimore's Ashburton filtration plant with **circular collection in square tanks**



LINK-BELT "SC" CIRCULINE SLUDGE COLLECTORS are shown in two of four tanks at Ashburton plant. As arms revolve, scrapers move settled sludge toward sump in center of tank. Link-Belt Straightline slow mixers are in foreground. The Arundel Corporation, Baltimore, general contractors; Mr. B. L. Werner, City Water Engineer; Whitman, Requaardt & Associates, Consulting Engineers.

Design permits efficient sludge removal with economical tank construction

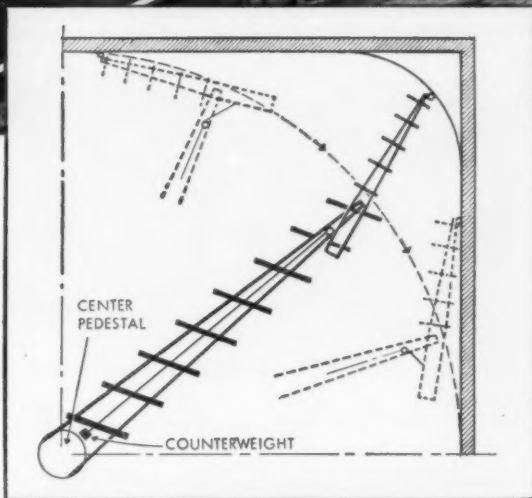
Chief advantage of rectangular settling tank design is the savings it offers in wall construction and piping costs. In addition, unit construction with slow mixers gives uniform distribution in the settling tank and prevents floc break-up. By choosing rectangular tanks with Link-Belt "SC" Circuline Collectors, the city of Baltimore, Md., was able to combine the benefits of both at its Ashburton water filtration plant.

Link-Belt has pioneered many advances in sanitary engineering. Today, 35 years' background and a broad line of built-to-last equipment support every Link-Belt recommendation.

A call to your nearby Link-Belt office will put you in touch with a treatment specialist. He's ready to work with your consultants and chemists . . . bring you the finest in modern equipment, for any water, sewage or industrial waste treatment requirement.

See our exhibit A.W.W.A. Convention, Atlantic City, May 12-17, Spaces 509-11

PUBLIC WORKS for May, 1957



RAKES attached to collectors at each end have wheels which roll along metal curb around bottom of basin. Cable and counterweight assure constant rake contact against guide curb.

LINK-BELT

SANITARY ENGINEERING EQUIPMENT

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

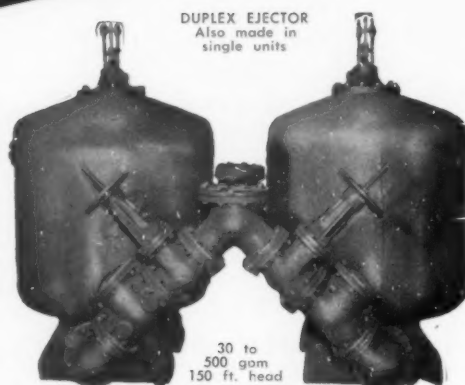
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Here's the answer to YOUR question of saving money and getting better results . . .

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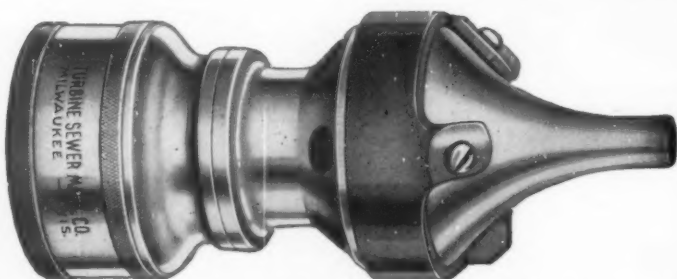
These time-tested pneumatic sewage ejectors do away with complex piping . . . screens, impellers, shredders and pumps that need constant cleaning . . . in short, give you BETTER sewage ejectors for less money. They have many exclusive features of design and control and operation that it will pay you to know about . . . write today for Bulletin S-50.



Send for Bulletin S-50. It includes piping diagrams for electrode and float switch controls, plus dimensions and layouts. A book that modern municipal engineers will find mighty interesting and helpful. Your copy's ready.

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Water." By W. B. Cooke and K. A. Busch, R. A. Taft Sanitary Engineering Center. Sewage and Industrial Wastes, February.

"B.O.D. Reduction by Chlorination of Phenol and Amino Acids." By R. S. Ingols and G. M. Jacobs, Georgia Institute of Technology. Sewage and Industrial Wastes, March.

"Detergent Builders and B.O.D." By G. W. Malaney and W. D. Sheets, Ohio State University. Sewage and Industrial Wastes, March.

"Sewage Treatment Facilities at Port Clinton, Ohio." By H. H. Hauenstein, Finkbeiner, Pettis and Strout, Engineers, Toledo. Water and Sewage Works, March.

"Refuse Transfer Station at St. Pancras." The Surveyor and Municipal and County Engineer, March 9.

"Detergents and Sewage Stabilization." By Laing Barden and P. G. C. Isaac, University of Durham. Contractors Record and Municipal Engineering, February, 13.

CHLORINE DIOXIDE for Water Treatment Generated Without Chlorine

ERNEST A. SNOW, JR.,

Senior Chemist, Amherst Laboratory,
Massachusetts Department of Health,
(In "Sanitalk")

MORE THAN 100 water treatment plants throughout the country have used chlorine and chlorine dioxide in water treatment. In practically all of these, the chlorine dioxide is generated from sodium chlorite solutions by bubbling chlorine gas through a reaction tower and the resulting mixture of chlorine and chlorine dioxide is fed into the water as a solution. The possibility of treating water with chlorine dioxide without chlorine has been investigated. It is well known that strong acids or strong bases will produce chlorine dioxide from sodium chlorite but generally the pH of the resulting solution is either much too high or much too low to be safely introduced into a potable water supply. Certain organic materials such as formaldehyde will also liberate chlorine dioxide from sodium chlorite but the use of such materials is not desirable in a water supply. The use of ferrous sulphate after a few preliminary experiments showed desirable possibilities, and a fairly intensive investigation was made through several semesters in the class on water and sewage analysis at the University of Massachusetts.

Preliminary experiments had in-

NEW **M-B** SWEEPERS

*handle more jobs
faster and
...easier*

**NEW! Hydraulic
2-Way Sweepers**



M-B Sweepers handle a variety of jobs in every season — jobs like cleaning dust, dirt and snow from streets, highways, sidewalks, playgrounds, driveways, intersections and parking lots; sweeping park lawns; and similar applications whenever a fast clean-up is necessary. There's almost no end to the many uses you can put these versatile units. Thoroughly engineered for most popular make tractors or tractor loaders.

New Hydraulic 2-Way Sweepers

Tractor-Mounted

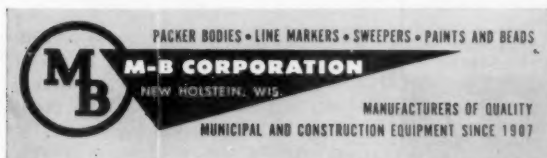
Loader-Mounted

New M-B 2-way sweepers are hydraulically driven and controlled — shift the broom 30° right or left of center for fast, two-way sweeping. Hydraulic pump may be installed for front drive or rear PTO mounting. Sweeper head bolts-up in minutes with snap couplings available for hydraulic hoses.

Floating action broom automatically adjusts broom pressure to surface contour; brush may be turned end for end for even wear; broom lifts 8" off the ground; broom widths of 5' and 6'; easily removable sweeper head; ball bearings throughout; guarded chain drives; and many other advantages. M-B Sweepers are also available with mechanical drive and hydraulic lift.

For complete information on the M-B Sweeper best suited to your needs see your tractor dealer, or write:

M-B CORPORATION
1611 WISCONSIN AVENUE
New Holstein, Wis.



**Mechanical Drive
One-Way Sweepers**



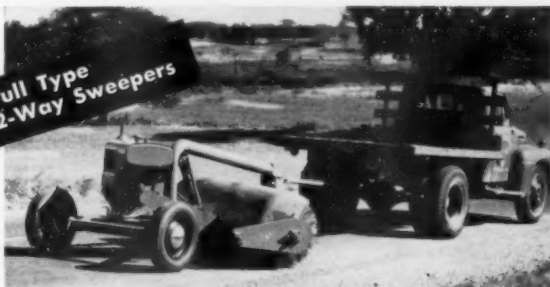
Engineered to fit most popular make tractors — 5' and 6' broom widths — versatile year 'round use.

**NEW! Loader-Mounted
Hydraulic 2-Way Sweepers**



Complete hydraulic control for swing, lift and brush drive — easily mounts in place of bucket on tractor loaders.

**Pull Type
2-Way Sweepers**



Big, heavy duty units for highways, airports and similar big-capacity applications — 2-way sweeping — traction-driven and engine-driven models.

"Best Ditcher For Irrigation Lines and Gas Mains"



VERMEER MIDGET DITCHER DIGS MORE... COSTS LESS

Here's just the machine for laying gas pipe, service lines and digging foundation footings. One man operation. Very maneuverable for those "tight spots." Only 48" wide, 6' high, 13' long. Digs 6" to 14" wide and can be transported in a pickup truck. Thousands in use. Write for complete information.

Some Excellent Distributor Territory Available

"My 4T Pow-R-Ditcher is the best machine I've ever used for irrigation lines and gas mains for the Kansas Power & Light Co. It's the finest small ditcher on the market for all-around performance and low cost ditching."

D. Catherman
SALINA CRANE & SHOVEL CO.
Salina, Kansas



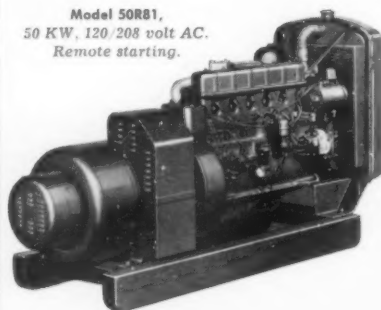
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Insure operation of essential equipment when power fails



Model 50R81,
50 KW, 120/208 volt AC.
Remote starting.



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Established 1873

A storm or accident may cut off central power for days—but no emergency occurs where Kohler electric plants provide standby protection. In water filtration plants they keep chemical feeds and mixers working and insure necessary lighting. In treatment plants they operate comminutors and lift pumps, and maintain prime on essential equipment. Gas or gasoline operated models, 1000 watts to 50 KW... Portable, lightweight, air-cooled Kohler electric plants—500 watts to 5 KW—provide reliable, on-the-job power for power tools on repair and maintenance trucks. Write for folder 5-F.

Plumbing Fixtures • Heating Equipment • Electric Plants • Air-cooled Engines • Precision Controls

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indicated that the use of the chlorite and the iron salt also would assist in the reduction of color. In one set of experiments, therefore, Amherst water, which is generally completely free from coliform bacteria but at times contains considerable color and occasional turbidity, was used in the experiments. In preliminary work very satisfactory removals of color as well as bacteria were obtained with the addition of appropriate amounts of sodium chlorite, ferrous sulphate and calcium hydroxide. It was found that the best procedure was to add the sodium chlorite and ferrous sulphate together and after thorough mixing to allow the treated water to stand for a thirty minute contact time. Then lime was added to a desired pH. In the first experiments, the water then was filtered through an experimental sand filter and resulted in very satisfactory reductions in color. However, an insufficient supply of sand filters was available and soon considerable amounts of iron were deposited and the filter became clogged. The filter also tended to remove the free available chlorine which was believed necessary for satisfactory bacterial elimination. It was also found that care in selecting the proper balance of chlorite and iron salts could avoid an excess of iron. In the later experiments, therefore, the use of the filter was eliminated and the results obtained were from supernatants after two hours settling.

Six parallel experiments were conducted with varying amounts of sodium chlorite, ferrous sulphate, alum and lime or soda ash. Generally speaking, the minimum proportion of ferrous sulphate used was 15 or 20:1 as compared to the amount of sodium chlorite. It was possible to use even somewhat higher ratios of iron salts. Since the Amherst water used in these first experiments contained practically no coliform bacteria, the water being examined was seeded with a dilute suspension of E. coli. In six runs, although approximately 100,000 coliform were present in the initial water, after two hours treatment, after 24 hours and after 48 hours, coliform were completely absent. Bacterial plates after 48 hours contact showed an average of about 2 spore-formers per milliliter of treated water. However, as shown in these experiments and in other work, there is a form of residual which represents chlorine which is either very slow to react or fails to react at all.

In another group of experiments,

INNER CIRCLES PROVIDE

Unique Sewer Recovery...



The crown of an obsolete and failing brick sewer in Toledo, Ohio was removed to permit relining by the Inner Circles Method with no interruption to surface traffic.

Threads Through Obsolete Brick "Egg" Sewers

another example of **PROGRESS IN CONCRETE**



Miners remove brick of inadequate sewer prior to installing Inner Circles. Brick invert is left in place to expedite hauling out brick ahead of workers and bringing in Inner Circles from behind.

The Inner Circles Method of relining and enlarging sewers is also adaptable for box, round arch, horseshoe and other varied tunnel shapes. Open trench cuts are eliminated, thus *reducing the delays and hazards of congested traffic*. Sewers are completed faster at less cost in any weather with fewer laborers and less equipment. The new two-way Tunnelugger can operate in either direction from a centrally located shaft—quickly delivering and positioning Inner Circles at either end while mining continues at the other.

*Send today for illustrated
Inner Circles Brochure*



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Hays Submerged Contact Aeration



City of Big Spring, Texas, Design: 20,000 population, 80 gallons per capita, 0.17 lb. B.O.D. with additional capacity for certain industrial wastes.

IDEAL for SMALL CITIES, SUBDIVISIONS, INSTITUTIONS

8 outstanding advantages make it to YOUR advantage to investigate Hays Process first.

Since 1938 A PROVEN PROCESS

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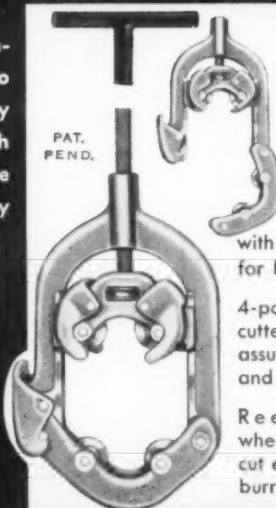
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IF YOU CUT LARGE DIAMETER PIPE...
YOU NEED THESE

New **REED** HINGED 4-WHEEL PIPE CUTTERS

Four sizes cover the range from 2½" to 12"

Users tell us these completely new cutters are so efficient they often "pay for themselves" through the savings in crew time on a half-dozen cuts. They are the first really practical tools for cutting off steel or cast iron pipe in sizes from 2½" to 12". You can, for example, cut 8" steel pipe completely off in less than five minutes.



Four wheel design requires minimum swing of handle—less digging in ditch work, easier "tight-corner" cuts.

Closed frame permits light weight with complete rigidity for better cutting.

4-point guide aligns the cutter on the pipe... assures perfect tracking and a right angle cut.

Reed Razor Blade wheels track perfectly, cut easily and roll down burr on steel pipe.

Unconditionally guaranteed to be the most efficient cutter you have ever used. Ask your jobber or write for literature.



MANUFACTURING COMPANY
ERIE, PENNSYLVANIA • U. S. A.

the Amherst tap water was used together with water from Hayden's Pond in Springfield and three samples taken from the canals in the water supply system of Springfield. All these waters were again seeded with a suspension of *E. coli* in pure culture. To each of the waters, sodium chlorite, ferrous sulphate, alum, lime and soda ash were added in that order and stirred slowly for twenty minutes. At the end of this time samples were taken for bacterial tests and the tests were made. No coliform survived even after twenty minutes, although a few spore-formers were found.

The above results indicate that a "one-shot" treatment using sodium chlorite and other chemicals can be used successfully to destroy coliform bacteria, reduce spore-formers, bleach the color and produce coagulation. In practice it is desirable to allow an extended period of sedimentation after which the clarified water would be fed to an appropriate sand filter. Post chlorination could be employed if it were found in practice that the residual chlorine resulting from the sodium chlorite did not survive after filtration. It has been found at Chicopee and elsewhere that the chlorine dioxide as such or sodium chlorite in a distribution system serves as a valuable carrier for chlorine and has extensive applications in carrying disinfection throughout the distribution system.

• • •

Mosquito and Fly Control Charges

Residents of Monte Vista, Colo., will pay 20c per month or \$2.50 per year to defray the cost of mosquito and fly dusting during the summer. This assessment will be added to all garbage collection bills. The rate will apply to both residential and business locations. The assessment is expected to raise approximately \$1800, sufficient for three good dustings during the summer and early fall.

• • •

Cost of Weed and Brush Control

Every mile of county road in Faribault Co., Minn., was covered at least twice with weed spray in 1956. The average cost of weed and brush control for 242.7 miles of county roads and for 149.5 miles of State Aid roads was \$57 per mile. Snow and ice control cost slightly over \$86 per mile for county roads and \$90 per mile on State Aid roads. Adrian G. Wrucke is County Highway Engineer.

Verti-Line® Pumps are made "Split-To-Pull"

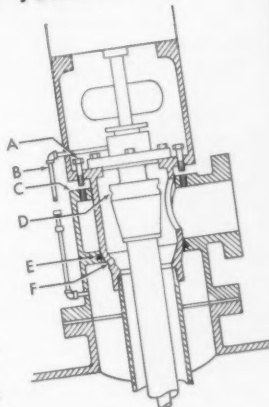
An entirely new Verti-Line concept for vertical pumps. The discharge head is "Split-to-Pull" making possible many advantages never before available with this type of pump. Here are a few:

May be flanged in line like a valve • Remove pump without disturbing piping • Pump case can be left in line, covered with blind flange • Minimum NPSH requirements • Completely self-priming • "Leakless-Packing" • "Overpressure-Overload" proof performance

Exclusive Verti-Line® Feature!

A new type of "split-to-pull" head makes possible removal of the pump from its position in tank, sump or pump case (barrel) without disturbing the piping or sump cover.

- A. By removing cap screws, pump is disconnected for removal.
- B. Bleed off return from packing gland minimizes leaks.
- C. Discharge accommodates American Standard Flange.
- D. Recirculating orifices permit fluid to return to pumping source.
- E. "O" ring seals pump and discharge head.
- F. Port in discharge box relieves excess pressure which may build-up in line.



CAPACITIES — from 2- to 30,000 GPM — Heads to 600 PSI. Whatever your needs for vertical pumps may be, investigate Verti-Line before you buy.

Verti-Line pumps are sold and serviced by independent distributors and dealers only.

Verti-Line Pumps are the exclusive products of
LAYNE & BOWLER PUMP COMPANY

general offices and main plant

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To meet a wide range of pumping conditions, Verti-Line Close-Coupled Industrial Pumps are available with two impeller types.

RADIAL FLOW

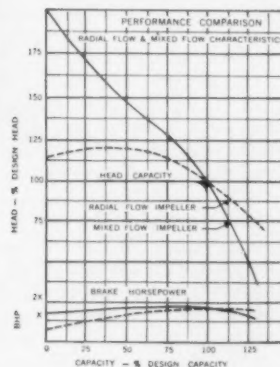


The flat head capacity characteristic of the Radial-Flow impeller is applied to systems such as fueling, condensate return and cooling towers, which operate at constant pressure against varying capacities, and under throttled conditions.

MIXED-FLOW



The steep head-capacity characteristic of the Mixed-Flow impeller is applied where constant capacity is required at fluctuating pressures such as pipeline pumps or units operating in parallel or series.



How to conduct a Meeting

L. A. KEATING

SOONER OR LATER you'll probably become an officer of some organization—business, civic, social or fraternal—and presently may find yourself assigned to conduct its meetings. While apprehension makes your heart pound you mutter, "I wish I'd never got into this. What, for goodness sake, do I do?"

Cease worrying, first. Your task will not be difficult. Having it is a privilege that will bring you valuable experience. It will make you known to people who otherwise might never have noticed you. If you have been wanting to stand out from the crowd, here is your chance.

Let's say that as the new president of your professional group you must preside at its meetings. Should you begin at once to memorize the labyrinth of do's and don'ts that make up Roberts' famed "Rules Of Order"? No—parliamentary bodies still use Roberts but business and professional groups do not. They lean on simplified meeting procedure worked out by experts. Your public library will have recent books on the subject. Or send a dime for "The Meeting Will Come To Order" to Cooperative Extension Service, Michigan State University, East Lansing, Mich., or a quarter for "Parliamentary Procedure" to the School of Speech, University of Denver, Denver, Colo. Both pamphlets are simple as a, b, c and contain everything you need. In fact, why not buy a number of copies and distribute them to your members? Let everyone know how to run your meetings efficiently.

The thought of walking out on a platform and taking command may make you wish you were in Timbuctoo, wherever that is. But your nervousness is natural. Everyone has it. Battle this nervousness in two ways: by preparing for your task; and when you stand up to begin, take plenty of time.

The great Caruso learned to take plenty of time. At every operatic performance he became panicky as he waited in the wings for his cue, "Always," he declared, "I completely lost my voice. When my cue came, automatically I walked out on the stage, but I could do nothing.



So I waited until I knew I was ready. Then I sang."

Walk to the podium. Strike your gavel once or twice. Turn your smile from one side of the hall to the other. Wait. When there is silence and you are ready, say, "Gentlemen, the meeting will please come to order." Wait, then continue, "Our first order of business . . ."

Before we go into that, let's set the ideal policy for conducting meetings everywhere. Whether you are president, chairman, discussion leader or toastmaster, begin on time so you can end on time. Above all, *Keep it bright, keep it brief and keep it going.*

Hold that in your mind as you preside. Apply it, and you will do a good job.

In general the order of business is the same for every organization, ten basic items which cover everything. For a specialized group one or another of these may be omitted. Or you may decide to omit certain items at certain meetings—for example, to have a treasurer's report only quarterly. Here is the ten-step sequence.

1. Call the meeting to order.
2. Roll call by the secretary. (Often omitted.)
3. Minutes read of the previous meeting. (By the secretary. Minutes can be summarized, omitted because mailed to members, or dispensed with if there is no objection.)
4. Reports, if any, from officers: a) president; b) vice-president; c) treasurer; and d) secretary.
5. Standing committee reports.
6. Special committee reports.

7. Unfinished business from last meeting.

8. Postponed business from any previous meeting.

9. New business and/or program.

10. Adjournment.

As presiding officer, decide in advance which of these requires particular attention and prepare a list you can consult during the meeting. Alert each person who must speak so he'll be ready. Have your treasurer quote club receipts under only three or four headings and disbursements similarly, and quote sums in round dollars. Your annual or semi-annual audit will check his records to the penny and should be mailed to each member.

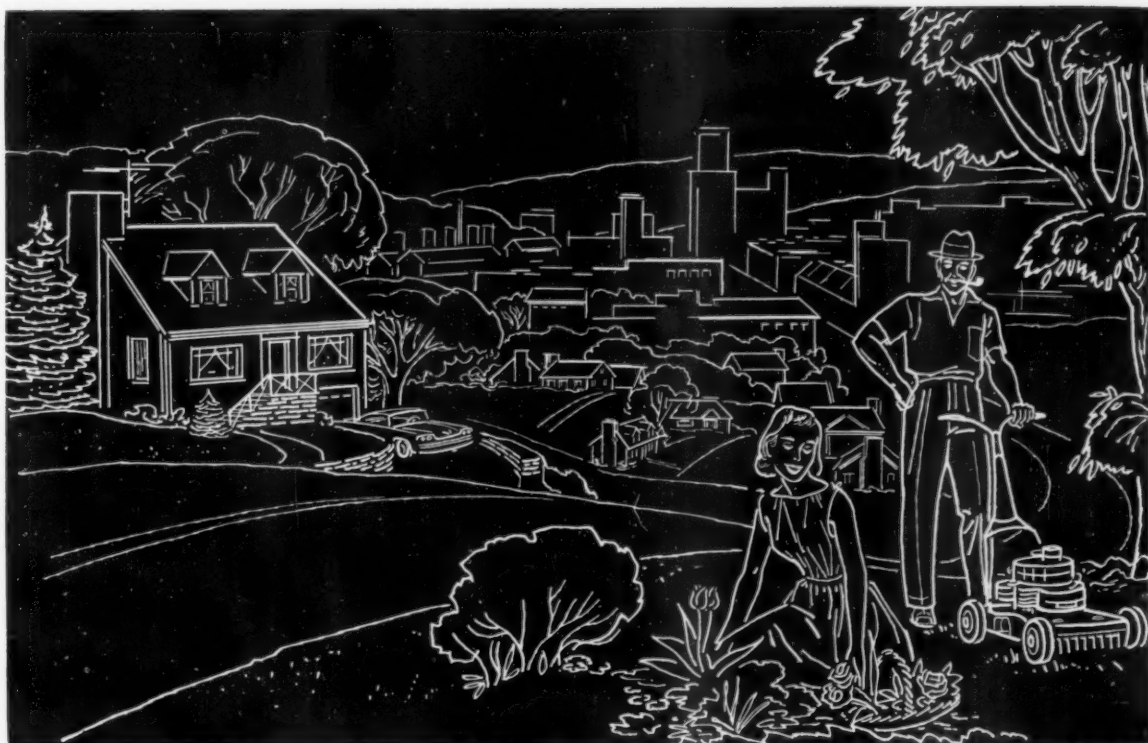
An over-long committee report often can be summarized orally; or have the chairman read four or five statements which epitomize his report. Explain that any member may consult the full report after the meeting. Keep a tight rein on treasurers, secretaries and committee chairmen likely to go into windy details that may put members to sleep.

To retain control of a meeting you need to know how to deal with motions, the means by which a group conducts its business. Learn how motions should be made and seconded, how they can be altered and, when amended, how to take a vote and which issue is voted on first. There are Privileged, Subsidiary, Incidental, Renewal and Main motions. The pamphlets mentioned earlier contain simple charts to which you can refer to make sure you are doing your job properly.

Keep it bright, keep it brief and keep it going.

To keep your meeting bright, act as if you are enjoying it. The light touch of humor is always welcome. Because a presiding officer must be impartial, forego sarcasm. Telling jokes may consume too much time, but if you tell one be sure it illustrates something. Playful flattery is usually acceptable as, "Next we'll hear from a handsome young man, target of half the pretty girls in town. Some day I'll ask Joe to give us a talk on 'How I've Stayed Single.' But for now, Joe, will you give your report?"

To keep the meeting brief, suggest beforehand to each person who



the billion-mile network of buried faith

Clay Pipe is trusted. It has to be. It's sealed in by streets and sidewalls . . . blocked off by building foundations . . . piled over with earth and rock.

Clay Pipe has a vital job to do, and it must not fail. Yet—nobody worries about the vast underground network of sanitary protection. Few people even think about it. What greater tribute could be paid to a product's dependability?

Clay Pipe goes underground, so it's got to be good. It guards against disease, so it's got to be good. It gets no maintenance, so it's got to be good.

And you can bet your sewerage bonds it *is* good, because it's backed by a written long-term guarantee. Clay Pipe is the only pipe that *never wears out*, and the Clay Pipe industry is mighty proud of it.



C-357-6

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MANUFACTURERS, INC.**
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Installing A-C pipe?

Cut it faster with a SPRING LOAD A-C PIPE CUTTER

This light weight, one-man cutter cuts square and true, clean and smooth—reduces cutting time 50%. Cuts within 1" of pipe end—no chipping, no spoilage, no loss. Cuts all sizes. Adjusts to size in seconds.

Hold it better with a SPRING LOAD PIPE VISE

Sets up in 10 seconds to hold pipe from 4"-20", in secure, non-slip grip. Holds pipe steady, at convenient height. Light, compact, yet rugged.



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Use these proven
one-man tools to
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First . . . and Best!

TODD INSECTICIDAL FOG APPLICATOR



*Successfully Used for over 12 Years in
Community Fly and Mosquito Programs*

Tifa was first in the field of fog applicators. Tests have proved it best in the field for space control around the community . . . on the dump over pools, in suburbs, *everywhere* insects swarm!

This amazing machine discharges newly-developed insecticides as well as the older types in a *true, clean fog* which spreads quickly and permeates the deepest crevices. This ability means a *better* insect control program for your community. Put Tifa to work for you.

CARRYING UNDERWRITERS' LISTING SEAL

Write for illustrated folder with details and official comments.

PRODUCTS DIVISION

TODD SHIPYARDS CORPORATION

Headquarters: Columbia & Halleck Sts., Brooklyn 31, N.Y.
Plant: Green's Bayou, Houston 15, Texas

must speak, "Hold it to three minutes, will you?" When floor discussion arises tell the members. "In the interests of fair play and getting home before breakfast, I shall recognize four speakers pro and four con, each for two minutes. Then each side will have five minutes for rebuttal. Agreed?"

If someone talks on and on, interrupt with reminder that his time has expired. If this fails say, "Mr. Jones, several others wish to be heard but our meeting is running long. Will you yield the floor?"

Keep your meeting going by firmly controlling it. Don't hesitate to interrupt with, "Sorry, you are out of order," or to gavel down a heckler. Assert yourself—with a smile—and the membership will thank you.

Especially when a program is being presented, keep it going at a good pace. Let each participant know ahead of time whom he follows and how much time he'll have. Then hold him to his turn and to his time. Shut off unnecessary encores or applause-milking by introducing the next turn.

There is nothing difficult, nothing to fear about conducting a meeting. Keep alert, keep smiling and have that chart of various kinds of motions and amendments handy in case your presiding is questioned. Repeat each motion so everyone understands it and announce frequently what is before the house at the moment. Your task is simpler than you now think, and there is no reason why you should not enjoy and profit from it.

The main thing about conducting a meeting is to *Keep it bright, keep it brief and keep it going.*

• • •

Growth of the Metropolitan Region of New York

A year of significant progress in the development by The Port of New York Authority of land, sea and air transportation and terminal facilities in the New York-New Jersey Port District was reviewed in the bi-state agency's 1956 Annual Report. At the end of 1956, the Port Authority had invested \$616,300,000 in its facilities in the Metropolitan Region of New York and New Jersey. This represented an increase of \$84,600,000 or 16 percent over the 1955 total of \$531,700,000. In addition, construction contract awards and contract commitments in 1956 totaled \$50,000,000, and capital expenditures of \$148,561,900 are budgeted for the current year.

Great progress was made particularly in the development of the



A Salute to the
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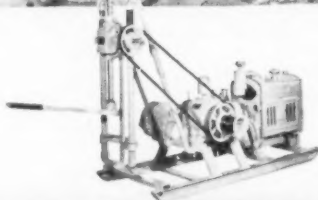
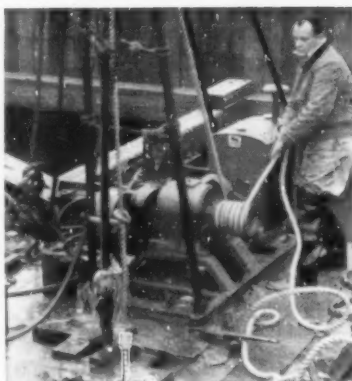
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\$120,000,000 "Terminal City" at New York International Airport; the \$100,000,000 third tube of the Lincoln Tunnel; the \$85,000,000 Brooklyn Port Authority piers; the \$18,000,000 Hoboken Port Authority piers; and miscellaneous major improvements at Port Newark, Newark Airport and La Guardia Airport. In addition, plans went forward during the year for the construction of the Narrows Bridge and the second deck of the George Washington Bridge and their approaches, estimated to cost more than \$500,000,000.

The Port Authority reported record use of its six interstate crossings. The total volume of 86,197,000 vehicles was up 0.8 percent over the 1955 total of 85,633,830. Gross operating revenues for 1956 totaled \$76,700,000, an increase of 12 percent over \$68,600,000 in the previous year. Net revenues of \$38,700,000, after including interest income and allowing for valuation adjustment of securities held in operating and reserve funds, were available for debt service payments and for transfer to reserves as required by statutes and agreements with bondholders.

• • •

Wanted!! Elm Tree Enemy Number One

The city of Richmond, Va. in its report for July, August and September of last year states that the city has 16,000 elm trees. Of this number 274 are dead of Dutch elm disease, another 180 are sickly and 9,000 had dead wood. The city has planned on spraying the trees with a heavy concentrate of DDT to control the beetle carriers. It is believed the job of spraying the elms can be done for about \$109,000. Treatment is expensive but far cheaper than removal of all elms and replacement at an estimated cost of \$2 million.

• • •

APWA News Bulletins

(Continued from page 148)

were: E. H. Lindstrom, Assistant City Engineer, Seattle; Oscar E. Olson, City Engineer, Centralia; Robert G. Anderson, Construction Engineer, Tacoma, and Rodney V. Colvin, City Engineer of Everett.

The items covered in the Committee's first report include the following: design and use of integral concrete curb, separate concrete curb, integral concrete curb and gutter, and a combined curb, gutter and sidewalk section. Also included were standards for the design of private driveway entrances, resi-



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dential street widths, and curb radii at street intersections, alley returns and private driveway returns. Copies of the report are available to members of the Association, on a loan basis, from the headquarters in Chicago.

Three New Trustees Named To APWA Research Foundation

Chicago, Ill.—Robert L. Anderson, President of the American Public Works Association, recently announced the appointment of three new members to the Board of Trustees of the APWA Research Founda-

tion, which is now functioning under the Chairmanship of Col. W. A. Hardenbergh, Editor, *PUBLIC WORKS* magazine.

The new appointees, each of whom were appointed for three year terms, are: Samuel S. Baxter, Commissioner, Water Department, Philadelphia, Pennsylvania; Myron Tatlock, Consulting Engineer, Dayton, Ohio, and Donald Bloodgood, Professor of Sanitary Engineering, Purdue University, Lafayette, Indiana. The Foundation was organized in 1955 to correlate research studies in this field, and to sponsor comprehensive investigations of public

works problems in the light of advancing knowledge of science and its many possible applications.

Its current activities are financed by nearly 200 cities that are "Public Agency" members of the Association. One-half of all service fees for this type of membership are now being allocated to support this activity. The fees vary from \$20.00 for small cities of less than 10,000 population to a maximum of \$300.00 for cities over 1,000,000 population. Counties, special districts and other governmental agencies are also eligible to apply for this type of membership. Further details may be obtained from the headquarters in Chicago.

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Paris Elected President of Southern California Chapter

Los Angeles, Calif.—American Public Works Association's Southern California Chapter installed Ben R. Paris president for 1957, at a recent meeting in the Rodger Young Auditorium in Los Angeles.

Paris, who served as First Vice President of the Chapter in 1956, is Director of the Los Angeles Bureau of Street Maintenance.

At the annual meeting for members of the chapter, Ty S. Miller, Supervisor of System Planning for the Southern California Gas Co., was principal speaker.

Officers named to assist Paris for the following year include: First Vice President Frank E. Randall, Right of Way Superintendent, Pacific Telephone and Telegraph Co.; Second Vice President John A. Lambie, Los Angeles County Engineer; and Secretary-Treasurer C. C. Westmoreland, Supervising Engineer, Southern California Gas Co.

In his talk during the afternoon business session, Miller explained the operation of a McIlroy electronic network analyzer recently installed by the gas company. Title of his talk was "Application of the Network Analyzer for Flow of Fluids in Pipelines."

This device, Miller explained, is an engineering tool for computing flow characteristics for fluids that respond to pipeline flow formula.

"The analyzer is particularly efficient and rapid when the problem is complex like involving changes in pipe diameter, or where alternate solutions are a possibility," he stated. "We also use the analyzer to check performance of existing piping systems by determining the system potential capacity that warrants investigation."

(Continued on page 235)

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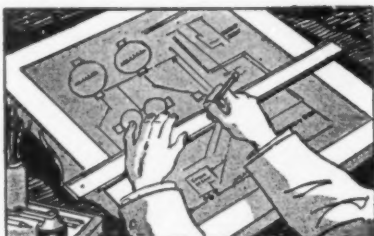
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John Lindell, former major league baseball player, related his experience as a professional ball player in an after dinner speech entitled "Youth in Baseball."

USPHS Sponsors Meeting On Solid Waste Disposal Problems

Washington, D. C. — Representatives of 11 national organizations, and other leaders in the sanitary sciences, recently met with officials of the United States Public Health Service to discuss community refuse disposal problems. Doctor Otis L. Anderson, Chief of the Bureau of State Services, USPHS, in calling the meeting, said "The disposal of refuse is significantly related to community health and sanitation, and the increasing demand for better solutions to the complex problems involved makes such a meeting desirable." He also noted that such a meeting had been suggested in a resolution adopted by the membership of the American Public Works Association at its recent annual meeting.

Representatives of the following organizations were in attendance at the meeting: American Municipal Association, Council of State Governments, American Public Health Association, American Society of Civil Engineers, Air Pollution Control Association, Conference of State Sanitary Engineers, Association of State and Territorial Health Officers, Conference of Municipal Public Health Engineers, National Association of Sanitarians, American Society of Mechanical Engineers and the American Public Works Association.

Shopping Center Sewerage (Continued from page 107)

pump which is interlocked with the lift station pumps. This recirculation pump operates when the lift station pumps are not in operation; returning a portion of the secondary effluent back to the high rate filter influent. This arrangement maintains a constant flow to the rotary distributor on the filter, which is necessary to obtain the best results through the filter media. From the secondary clarifier the sewage flows into a chlorine contact chamber for sterilization, and then into an outfall line which terminates at a natural water course.

The equipment used in the treatment plant is as follows: Two Fairbanks-Morse wet-pit type sewage pumps are used to deliver a minimum of 100 gpm against a 35-ft.

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tdh. The chlorinator is Wallace & Tiernan, designed to deliver from zero to twenty-five pounds of chlorine per 24 hours.

Operation of the pumps is controlled by Automatic Control Co. float switches. The Spirahoff equipment was manufactured by Yeomans Bros., including the sludge recirculating pump installed to break up any layer of scum that might form in the upper dome of the hood. This pump is rated to deliver a minimum of 75 gpm against a 5-ft. t.d.h. and is equipped with a time clock control. The secondary clarifier recirculation pump, also by Yeomans, is rated to deliver a minimum of 50 gpm against a 25-ft. t.d.h.

The Yeomans high rate trickling filter rotary distributor is designed to operate under a static head of 4½ feet and to apply a maximum of 0.24 mgd of sewage to the filter. The distributor will operate satisfactorily when the flow rate drops to 0.08 mgd at the same head.

Simmerson and Bell, Consulting Engineers of Jacksonville, designed the system and supervised its construction.

• • •

El Centro Water Plant

(Continued from page 120)

proximately 3/16 inch. The filter control tables were shop-fabricated of anodized welded aluminum, and are completely weather-resistant.

Project Costs

The overall project includes the raw water storage basins, the treated water tanks, and the treatment plant and building, as well as the transmission mains into the city. Steel cylinder pipe was used for the pipelines, and the valves are of the lubricated plug type. Two lines were provided from the plant into the city by different routes: one secondary line of 6000 feet of 18-in. pipe, and the main line of about 7000 feet of 24-in. and 30-in. pipe. The plant was built under four separate construction contracts, as follows: Treatment plant, including raw water structures and yard piping, \$647,000; raw water basins, \$174,000; treated water tanks, including paint and cathodic protection, \$164,000; and transmission pipelines, \$171,000.

The city purchased the treatment and control equipment, pumps and compressors, generator, and wash water troughs directly from manufacturers and suppliers, and furnished them to the General Con-

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tractor for inclusion in the project.

The approximate breakdown cost of the filter plant and building, excluding the high service pumps and the treated water storage, amounted to about \$750,000, or about \$50,000 per million gallons of capacity. The total project cost, including land and fees, was \$1,450,000.

The foundation investigations for the project were made by the Converse Engineering Co. of Pasadena, and the designing and supervising engineers for the project were Golden, Bryant & Jehle, Architect & Engineers, of El Centro. Leonard McClintock, City Manager, administered the project for the City of El Centro.

Surface Treatments*(Continued from page 112)*

150 percent of the quantity required for the first course stone. A good rough rule for bitumen requirements for multiple surface treatments is 0.1 gal. per sq. yd. for each 10 lbs. per sq. yd. of aggregate applied.

Within reasonable limits the distribution of the total bitumen between courses of a multiple surface treatment is not particularly significant except that the last application should be fairly heavy in order to provide a sealed surface. As an example the distribution of 0.5 gal. per sq. yd. for a double surface treatment might reasonably be 0.3 first course and 0.2 second course, or 0.25 first course and 0.25 second course, or 0.2 first course and 0.3 second course.

Construction procedures for multiple surface treatments are essentially the same as those for single surface treatments except that the process is repeated either two or three times. The procedure for a double surface treatment consists of the following steps: (1) Placing first course bitumen; (2) placing first course aggregate; (3) blading or brooming first course aggregate to obtain uniform distribution; (4) rolling first course aggregate; (5) second course bitumen application; (6) application of second course aggregate; and (7) rolling second course aggregate (light broom dragging may be used after initial rolling).

For a three course surface treatment steps 5, 6, and 7 are repeated for the third course. All courses should be completed the same day; this requires that only the amount of first course aggregate be placed which can be covered by succeeding courses.



Unit can also be used in street flushing and dewatering



Compacting base close to bridge abutment with Hydra-Way

Septic Tank Cleaner

Novo Pump & Engine Co. has a completely integrated septic tank cleaning unit. Designed for mounting on any truck chassis is a 1500-gallon tank unit complete with all of the latest equipment needed for septic tank cleaning. A "Light Rod", a unique measuring device with which to determine scientifically the need for cleaning a septic tank, is included. Other equipment includes a double diaphragm pump with electric starter having a capacity of 9000 gph; fresh water compartment with separate water pressure system; electric hose reel and hose; 3-in. special aluminum suction pipe (in 10-ft. lengths) with quick connect couplers; special aluminum suction nozzle; and electric "eel" with related tools. Also a new type "Electronic Witch" for locating septic tanks and sewer lines. A piping arrangement incorporating Rockwood 1/4-turn ball valves enables the operator to power load and unload the carry tank as well as flush the tanks, lines and pump with fresh water. The unit works equally well in servicing flooded basements, cistern dewatering, emergency fire fighting and street flushing. For further details write Novo Pump & Engine Co., Lansing, Mich., or circle No. 5-1 on the reply card.

Twin Casters On Barber-Greene 702 Ditcher

The twin caster wheel assembly for the Barber Greene Model 702 ditcher is now optional on all machines of this type. The twin caster,

Ottawa Hydra-Way Compacts Close to Structures

The Ottawa Hydra-Way is used to compact base close to structures where sheepfoot rollers cannot reach. In addition to this Model HW-C Hydra-Way attachment for crawler tractors, Ottawa Steel also offers complete self-propelled Hydra-Way units, powered by 57 hp prime movers. The tamping tower on the rear is interchangeable with an 11-ft. deep digging backhoe, and the front

end of the unit is equipped with either a heavy duty industrial 1-cu. yd. loader or hydraulic angledozer. The tower swings in a 130° arc, to break concrete or compact backfill to 100 percent in 4 to 6-ft. lifts, in a 135-sq. ft. area from one standing position. For complete details write Ottawa Steel Division, L. A. Young Spring & Wire Corp., Ottawa, Kans. or circle No. 5-3 on reply card.

with two wheels mounted 24 inches apart has advantages in urban service work. When laying service lines across paved streets, it is sometimes the practice to break out the pavement ahead of the ditcher to reduce wear on the digging boom. Since the trench is dug through this broken out area, the single caster wheel would also have to run through this rough path while the twin caster wheels will readily "straddle" the area. More details from Barber-Greene, Aurora, Ill., or circle No. 5-2 on the card.



Twin caster assembly can be installed in the field in not more than 4 hours

Flanged Clamp Designed to Stop Leaks at Pipe Joints

A clamp, introduced by Burlis Products Co. is now available for stopping water leaks at pipe joints. It seals joint leaks and clamps tightly on both the threaded pipe end and the fitting, reinforcing the joint. Inside the clamp there is a cut-back to make room for a soft Neoprene rubber ring which is squeezed into the threads at the source of the leak when the clamp is tightened into place with its four bolts. Each half of the clamp has on the inside a long tongue to fit into a deep channel to make a compact pipe-sleeve (even if the pipe is out of alignment). These clamps are made of cast aluminum in 5 sizes from 3/4 in. to 2-in. They fit standard malleable fittings, wrought and steel pipe and 85 percent copper pipe and screwed brass fittings. For further details write Burlis Products Co., 1619 Bergen St., Brooklyn 13, New York, or circle No. 5-4 on the reply card.

PUBLIC WORKS EQUIPMENT NEWS

Pavement and Form Roughness Indicator



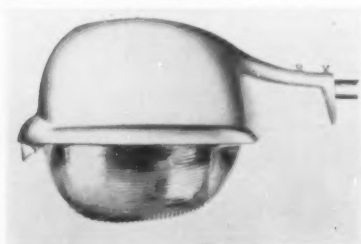
Spring-loaded line level comes with unit for accuracy checking and zero setting

An easy-rolling straight edge for rapid detection of high or low places on forms and pavement slabs has been developed by the Viking Mfg. Co. The Viking "Hi-Lo Detector" dye marks slab areas not within specification. The Hi-Lo is lightweight, consisting of a 10-ft. aluminum beam which rolls on ball-bearing aluminum rubber-tired wheels. A center wheel measures up and down variations of the surface. These variations are magnified 20 times on a large scale graduated in $\frac{1}{8}$ -in. readings. The unit is guided by a bar handle and has a

steerable front wheel. The dye marker is controlled with the left handle grip, permitting an inspector to cover and mark a slab at an easy walking pace. By lowering the wheel guides, the Detector can be used on forms. An outboard stabilizing leg allows the machine to stand upright unattended. The Detector locates high and low joints, permitting form crews to raise or lower forms with tamper bars faster and more accurately than by eye sighting. For additional information write to Viking Mfg. Co., Manhattan, Kans., or circle No. 5-5.

Luminaires For Color Corrected Mercury Lamps

The first luminaire specifically designed to use corrected mercury lamps for high intensity lighting of roadways and other areas is available from Westinghouse. The new OV-35 luminaires produce Type III IES-ASA distribution with Types J-H1, B-H17, and B-H18 lamps. The luminaires are available with either $1\frac{1}{4}$ -in. or 2-in. end mounting for direct attachment to standard poles and brackets. The bracket clamp is easily accessible but enclosed for weather protection and neatness.



The refractor and ring assembly can be opened and closed by one-hand operation to give complete access to lamp, reflector, bracket clamp and wiring connection. Although different reflectors are used for the 400-watt and 700-watt mercury lamps, they are easily interchanged. The new luminaires weigh approximately 31 pounds and are $16\frac{1}{2}$ inches wide by $17\frac{3}{8}$ inches deep by $20\frac{5}{8}$ inches long. For further information write Westinghouse Lighting Division, Edgewater Park, Cleveland, Ohio, or circle No. 5-6 on the reply card.

Close-Coupled Swimming Pool Pumps

Marlow pumps is now offering a new line of efficient, self-priming pumps and strainers for filter and vacuum cleaning service. This new unit is a combination of a self-priming pump, strainer and motor mounted on a pressed steel base. The self-priming factor makes possible

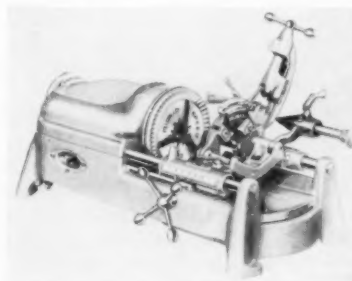
above ground installations. It is equipped with both vertical and horizontal discharge ports which allow a wide choice of piping arrangements. No check valves are used to restrict the flow. Strainers are available in two sizes. The small unit has $1\frac{1}{2}$ -in. suction and provides 38 in. of open area, while the larger strainer is arranged for 2-in. suction and 60-in. open area. This new line is available with $\frac{1}{3}$ to $1\frac{1}{2}$ -hp motor. For further information write Marlow Pumps Div. of Bell & Gossett Co., Midland Park, N. J., or circle No. 5-7.

Portable Brush Cutter

A one-man portable brush cutter that is ideal to clear undergrowth, tangled brush and saplings is announced by Rowco Mfg. Co. The unit is 5 feet 10 inches in length and is powered by a two-cycle, air-cooled motor. The saw blade is 10 inches in diameter and made of 14 gauge shatterproof steel, wide set. Standard equipment includes an engine guard stand, saw blade grass shield, brush guard handle and positive on-off ignition switch. For further details write Rowco Mfg. Co., 84 Emerald St., Keene, N. H., or circle No. 5-8 on the reply card.

Pipe and Bolt Threading Machine

Availability of the new Ridgid 535 pipe and bolt threading machine, featuring an entirely new universal die head, is announced by The Ridge Tool Co. The two sets of dies thread $\frac{1}{2}$ -in. to 2-in. pipe or conduit. One set of dies threads $\frac{1}{2}$ -in. to $\frac{3}{4}$ -in.; the second set threads 1, $1\frac{1}{4}$, $1\frac{1}{2}$ and 2-in. The complete 535



package also includes the cutting and reaming tools previously available only in the Ridgid 500 and 500A. These are a roll-type cut-off with self-centering, full-floating cutter wheel and a five-flute cone reamer with $\frac{1}{8}$ -in. to 2-in. capacity. Operating independently, all tools swing up and out of the way when not in use. For full details write The Ridge Tool Co., Elyria, O., or circle No. 5-9 on the reply card.

Witt Stainless Steel Cans Meet Health Requirements



Steel cans and pails are constructed of 24 gauge type 304 stainless steel

New stainless steel cans and pails, recommended for use where health and sanitation requirements are rigidly enforced, have been developed by The Witt Cornice Co. Witt stainless steel cans and pails are constructed of 24-gauge type 304 stainless steel with a 2B finish. They are equipped with 1/8-in. x 2-1/4-in. stainless steel plain bands at top and bottom. A snug-fitting lid locks out foreign matter, yet is quickly removed. The cans are available in 12 1/4, 16, 20, 27 and 33-gallon sizes. Pails are sized in 5, 7, 8 1/4 and 20-gallon capacities. Complete information from The Witt Cornice Co., 2121 Winchell Ave., Cincinnati 4, Ohio, or circle No. 5-10 on the reply card.

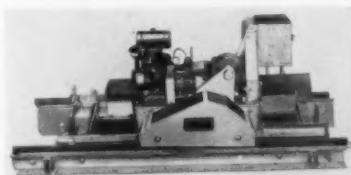
Two-Way Hydraulic Loader

The Merton Two-Way loader, announced by Seaboard Equipment Co., is a diesel-powered hydraulic loading shovel. It is self-powered up to 13 1/2 mph and can discharge its bucket at the front or over the rear. The height of the discharge can be varied from ground level to 9 ft. in front and from 4 ft. 10 ins. to 9 ft. at the rear. Only two pairs of double-acting hydraulic rams are used to control all bucket movements; the main lift rams incorporate an effective damping device which automatically slows down the bucket as it travels over top-dead-center, greatly reducing the stresses on the ram packings and on the machine as a whole. A 7/8-cu. yd. bucket and a 24-second operating cycle give the loader an output of approximately 100 cu. yd. per hour. A fully-enclosed operator's cab with large safety glass windows provides maximum visibility and protection. The loader can be used in quarries, earth moving, excavating, road work, cargo handling and similar

operations. For details and specifications write to Seaboard Equipment Co., Inc., 7 Hanover St., New York 5, N. Y., or circle No. 5-11 on the reply card.

Curb and Gutter Paver Has Vibrator, Tamber, Reversing Clutch

The Model S-57 curb and gutter paver announced by Dotmar Industries, has a vibrator mounted on the rear hopper that assures smooth flow of grout or concrete resulting in smoother troweling. The hopper is mounted on rubber to prevent transmission of vibration to other parts of the machine. A mechanical tamber with its tamping shoes operating in the forward hopper assures a uniform concrete structure. A new clutch between engine and wheel drive transmission enables the machine to be operated forward or in reverse. The unit can be backed up for second pass where necessary. The paver lays and finishes up to 100 lineal feet per min-



Paver lays 10 lineal feet per minute

ute and the machine can be readily adapted for paving integral gutter, curb and sidewalk, or sidewalks alone up to 72 in. wide and highway median strip or widening strip. For further details write Dotmar Industries, Inc., 502 Hanselman Bldg., Kalamazoo, Mich., or circle No. 5-12 on the reply card.

2-Way Hydraulic Sweeper

A new two-way sweeper, completely hydraulic in drive and controls, has been added to the line of tractor-mounted sweepers manufactured by the M-B Corp. For fast two-way sweeping, the broom may be angled 30° to the right or left. The hydraulic ram swings the broom to any position within the 60° radius and is controlled by the operator from the driver's seat. The large hydraulic pump may be front mounted or rear PTO driven, depending on tractor make. The unit is engineered to fit most popular make tractors. Adaptation of this sweeper head is also being made for mounting in tractor front-end loaders in place of the bucket, with a quick-mounting arrange-



Sweeper fits most makes of tractors

ment. They feature 6-ft. broom lengths; adjustable, spring-loaded broom ground pressure to follow the contour of the surface being swept; 8-in. hydraulic broom lift for clearing curbs, obstructions and for traveling; ball bearings in drive and brush mounting; and an easily removable sweeper hood for snow sweeping. Complete information may be obtained by writing to the M-B Corp., New Holstein, Wisc., or circle No. 5-13 on the reply card.

Dig Alongside Buildings With This Backhoe

A new development that provides a 200-degree operating arc on the new 210 Davis backhoe is announced by Mid-Western Industries. The arc is provided by a rotary hydraulic boom swing cylinder that gives a constant and smooth but cushioned swing. The arc is accomplished without use of cables or without the changing of any pins. Other 210 exclusives include the interchangeable mounting locations on each end as well as the center of the frame. This makes it possible to switch operating positions from center to side for flush digging alongside buildings, fences and other places where digging formerly had to be done by hand. The Davis backhoe is also available in the popular Model 185 which is known for its ability to work at right angles to the tractor. For full details write Mid-Western Industries, Inc., 1009 South West St., Wichita, Kans., or circle No. 5-14 on the reply card.



Davis backhoe is mounted on side for flush digging alongside any structure

Loader For Maintenance Work

The TI-20D Tracto-Loader, a 22-, 100-lb., 4-wheel drive, 2-cu. yd. front end loader is announced by Tractomotive Corp. An outstanding feature of the machine is the one-lever power-shift and direction control. Only one lever is used to select any of three speeds in either direction. The operator can shift from any forward speed to any reverse speed at any time and under full power. Top travel speed is 23 mph and for safety and handling ease, it has power steering and four-wheel power brakes which can be operated by either the right or left foot. The 2-cu. yd. bucket can be tipped back 40° at ground level and maximum dumping clearance under the hinge pin is 11 ft. 7 in. Reach from the forwardmost part of the machine to the cutting edge at maximum dumping height is 2 ft. 10 in. For further details write Tractomotive Corp., Deerfield, Ill., or circle No. 5-15 on the reply card.

Compact Sweeper Mechanizes "Problem" Area-Clean-Up

To further mechanize the sweeping of parking lots, ramps, garages, sidewalks and bridges, the G. H. Tennant Co., has developed a compact power sweeper that covers a 53-in. path (with curb brush). Called the Model 80, it is equipped with rear-wheel, cam- and lever steering and 65-in. turning radius to make sharp angle turns when sweeping in congested areas. A revolving 42-in. main broom throws litter directly forward into a 12-cu. ft. hopper. This floating-type hopper rises when bulky debris is encountered, allowing on-the-run sweep-up of large objects, such as pop bottles, rocks, etc. A high-volume vacuum fan sucks dust from the enclosed brush compartment, "trapping" it in a large (4200-sq. in. filter area) fabric bag. Further information is available from the G. H. Tennant Co., 755 N. Lilac Drive, Minneapolis 2, Minn., or circle No. 5-16 on the reply card.



Size and high maneuverability of the Tennant sweeper permits fast sweeping

HTH Tablet Hypochlorinator

The HTH tablet hypochlorinator made by Fischer & Porter Co., is used for small chlorinating jobs on swimming pools, ponds, sewage, industrial wastes and potable water. It is also used to prepare chlorine solutions for sanitation purposes in dairies, bottling works, breweries and food processing and packing plants. The unit is a device for the continuous generation of chlorine

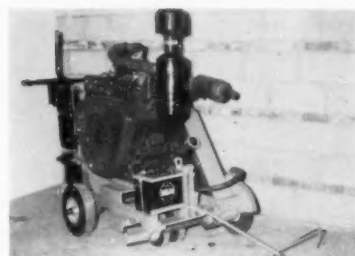


Hypochlorinator is used for chlorinating swimming pools, sewage and wastes

solution from calcium hypochlorite tablets. It combines the functions of tablet reservoir, dissolver and metering unit. For further information write Fischer & Porter Co., 937 Jacksonville Road, Hatboro, Pa., or circle No. 5-17 on the reply card.

Submersible Electric Pumps

A multi-purpose 35-pound submersible electric pump, which handles 3,300 gph at 5-ft. head, is offered by Speed King Mfg. Co. The pump is compact, being 11 inches high and 11 inches wide. The 1½-hp, single phase electric motor is hermetically sealed for trouble-free operation, completely submerged. The pump is corrosion resistant, even in salt water. Typical uses are for small excavations and low spots, flooded basements and general utility pumping around plant and yard. Float switch is standard equipment for automatic operation. For further information write Speed King Mfg. Co., Div. of The Jaeger Machine Co., Columbus 16, O., or circle No. 5-18 on the reply card.



Unit cuts straight and uniform lines

Self-Propelled Concrete Saw

The WL70-SS, 70-hp self-propelled concrete saw, using a Lycoming power plant has exceptional stability and maneuverability. Diamond or abrasive blades, to and including 22-in., are included on the standard machine. Faster and easier turning and spotting of the machine makes the cutting job faster and cheaper. Sufficient power is provided to cut a full 8½ inches in all material with allowance for reserve power to eliminate blade speed fluctuation. For full data write Windsor Machinery Corp., 85 Grossmire Ave., Elmwood 10, Conn., or circle No. 5-19 on the reply card.

Improved Utility Ditcher

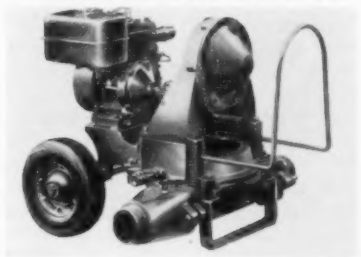
A utility ditcher that incorporates foot pedal steering, a shiftable spoil conveyor and new hydraulic controls has been announced by Gar Wood. Specially designed for "stop" and "go" utility ditching, the compact Model 403 is equipped with a hydraulic pump that provides full-time hydraulic pressure for instant control of the digging boom. The system eliminates the need for a hoist-clutch, while at the same time reduces the number of moving parts. A foot-pedal steering arrangement on the ditcher replaces hand levers, providing the operator with greater control and accuracy. The ditcher has a maximum digging capacity of 5 feet deep and 12 inches wide, or 4 feet deep and 16 inches wide. For further information write Gar Wood Industries, Inc., Wayne, Mich., or circle No. 5-20 on the reply card.



Attachment Increases Utility Blade Application

End extension pieces for utility blades, bringing the overall width of the blade to 8 ft., have recently been announced by the Arps Corp., The extensions are contoured to fit the Arps models AB-6 and AB-7 blades and are equipped with reversible cutting edges. They add 1-ft. to each end of the blade, giving it added capacity for moving loose dirt and snow and are conveniently bolted to the blade, making them extremely easy to attach and remove. The utility blades are available for most popular make tractors. For full details write Arps Corp., New Holstein, Wisc., or circle No. 5-21 on the reply card.

Lightweight Diaphragm Pump



Pump is compact and weighs 125 lbs.

A new easy-to-handle diaphragm pump has been announced by The Ralph B. Carter Co. The pump weighs 125 lbs. and is a full capacity 3-in. unit. It is rated at 4200 gph, and this body and housing are cast of high strength aluminum alloy. Streamlined waterways minimize internal friction, body design allows full displacement action of the diaphragm, resulting in full capacity on every stroke. Engine power is transmitted to the totally enclosed drive through a shock absorbing flexible coupling. The full swing check valves are made of a neoprene compound and are designed with oversize weights to insure positive seating on every stroke. Fittings are available in 2 and 3-in. IPS suction and discharge. Choice of power includes gasoline engine or electric motor drive. For full information write The Ralph B. Carter Co., Hackensack, N. J., or circle No. 5-22 on the reply card.

New Litter Getters

These powerful, flexible suction units pick up all kinds of trash: newspapers, paper cups and wrappings, tin cans, pop bottles, leaves, etc. The Tarrant Mfg. Co. has designed two general types of these



Unit will handle most roadside litter

vacuum cleaners: the Gutter-Vac and the Litter-Getter. The Gutter-Vac models for Jeep and pick-up truck mounting are equipped with dust-filtered litter receiving compartments. Gutter-Vacs are designed mainly for picking up gutter litter found along street curbs. The Litter-Getters are trailer-mounted units. One model is designed for picking up litter and blowing it into large truck mounted boxes. A second Litter-Getter model with its own built-in trash receiver is especially adaptable and used for picking up more widely scattered litter found on highway shoulders and center malls, public parks and recreation areas. For more details write to the Tarrant Mfg. Co., 28 Jumel Place, Saratoga Springs, N. Y., or circle No. 5-23 on the reply card.

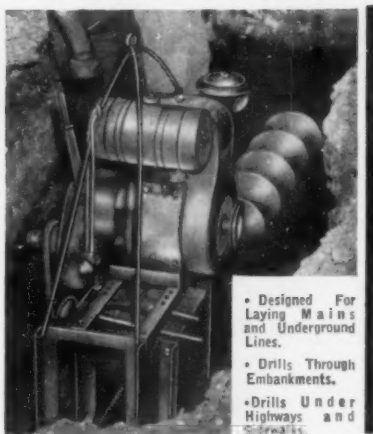
Cast Iron Pipe Joint

This Clow pipe joint is a rubber seal joint, which uses only a molded rubber gasket for its seal. No follower ring or bolts are required. Its features are fast, simple assembly and an "all-weather" joint that is tight under virtually any or all trench or weather conditions. For more details write James B. Clow & Sons, Inc., 201-299 North Talman Ave., Chicago 80, Ill., or circle No. 5-24 on the reply card.



Joints approved for 350 psi pressure

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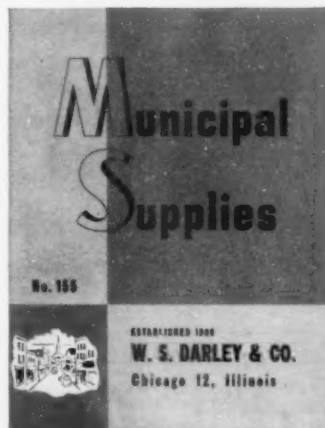
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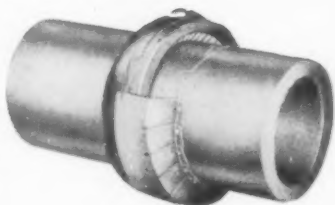


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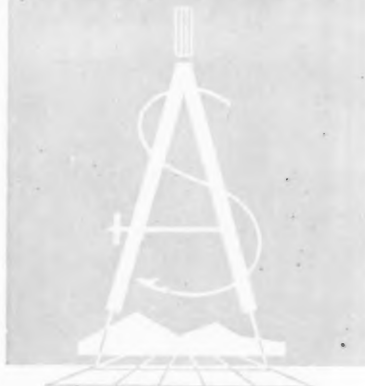


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Power Feed Attachment For Holan Digger

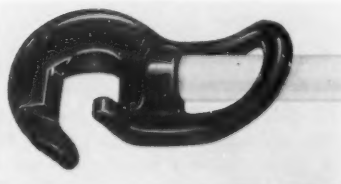


Unit can dig into hard ground and there is no need for a man to guide the diggers

Three power feed attachments for Holan diggers are now being manufactured by J. H. Holan Corp. The new attachments use the weight and hydraulic power of the derricks to feed diggers into the ground. The downward force, created entirely by the live-boom derricks, makes it easy to dig into hard ground and there is no need for a man to guide the diggers. The Series 4407 power feed linkage and the Series 4411 rigid bracket-type power feed were designed for Holan's Series 3700

derrick, and the Series 4412 bracket-type power feed for the Series 5700 derrick. The linkage is attached to the side legs, whereas the bracket types are located on the middle leg. The two bracket types make it possible to get under low lines easier because the digger is closer to the derrick. The 4411 has a torque arm for the built-in swivel. All Holan derricks, diggers and power feeds stow overhead. Write J. H. Holan Corp., 4100 West 150th St., Cleveland 11, O., or circle No. 5-26.

Pipe Puller For Water Departments

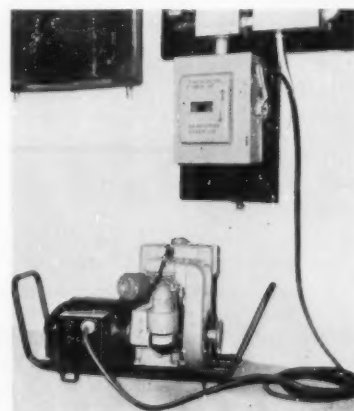


Offered by Reed Mfg. Co. for use on 3/4-in. to 2-in. pipe, this pipe puller is used by plumbers and water departments when renewing old and corroded curb-to-house water lines without ditching. In this application, an access pit is dug at the curb, the old line broken and a coil of copper water tube attached. The Reed puller is then used to grip the basement end, bringing the copper tube along. Made of ductile iron with hardened jaws, the puller can handle runs of as much as 75 feet. More details from Reed Mfg. Corp., Erie, Pa., or circle No. 5-25 on the reply card.

Generator for Emergency Stand-By Power

Close voltage regulation and generous overload capacity are among

the many features combined in the gasoline engine generators just announced by Homelite. The 3000-watt generators were developed for city, county and state maintenance departments to provide dependable power for floodlights, portable electric tools and emergency stand-by service. Lightweight, easy to carry to any job location, the units have no BC brushes, commutators, DC windings or intermediate couplings. For further information write Homelite, Port Chester, N. Y., or circle No. 5-27 on the reply card.



Tree Stump Remover

A stump remover, called the "Stump Hearer", is designed to solve both the problems of stump removal and stump disposal by quickly grinding the tree stump down to as much as 14 inches below ground level. The depression can be covered with earth and the wood chips or shavings produced by the cutting action easily disposed of or used as mulch in the surrounding grass areas. The new machine, made by Exeter Co., consists of a cutting head fitted with steel blades swinging on an adjustable arm fixed to a center post. The head is operated by an electric motor powered by a generator. The entire unit is mounted on a mobile, pneumatic tired trailer that can be towed at full road speeds by auto or truck. Designed for fast, one-man operation, wheel barrow type handles guide the cutting head into the stump and can be swung through an 8 ft. radius without moving the trailer. The head is adjustable to cut from 12 inches above to 14 inches below grade. For complete information write The Exeter Co., P. O. Box 511, Bloomfield, N. J., or circle No. 5-28 on the reply card.

Magnetic Sweeper for Multi-Purpose Use



The Sabre-Netic magnetic sweeper is now available for city, county and state use. Featuring a powerful electro-magnet, the unit quickly cleans an area of all metallic objects eliminating the hazards of tire damage. The sweeper is excellent for hi-way sweeping and is powered by a Continental engine, attaining a speed of 12 mph. The hydraulic lift system provides smooth, positive lifting action. A separate power generator provides 125 volts, 40 amps current for the electro-magnet. Optional attachments convert the machine into other uses such as a snow-plow, grader or conventional pulling tractor. Models are available with or without cab. For further details write Sabre Metal Products, Inc., 8000 W. 47th St., Lyons, Ill., or circle No. 5-29 on the reply card.

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Thousands of progressive engineers are finding that our readers' service section is the easy, handy way to obtain new catalogs of advertised products. Be sure and return the postage free reply card opposite page 68.

SEE PAGES 40 TO 60

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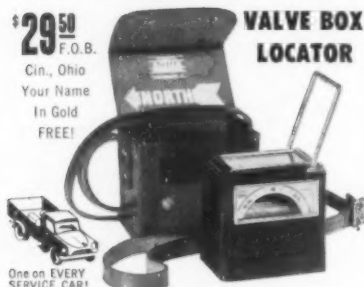
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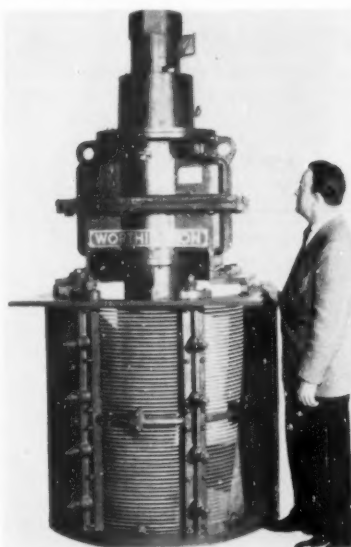
APCO

Henry Super Backhoe

The new Super C-10H backhoe, announced by Henry Mfg. Co., digs 12 feet with telescopic boom, 10 feet with special boom. Both units load 8½ feet high. Both telescopic and special models are available with either hydraulic or manual outriggers. These outriggers will level up the machine for straight down digging even on a 25 percent slope. The main frame rests solidly on the ground, so there is no backhoe weight on the tractor while digging. Both the telescopic and special booms will swing 160° and will dig from any angle within that arc. For further details write to Henry Mfg. Co., Inc., 1700 N. Clay Street, Topeka, Kansas, or circle No. 5-30.

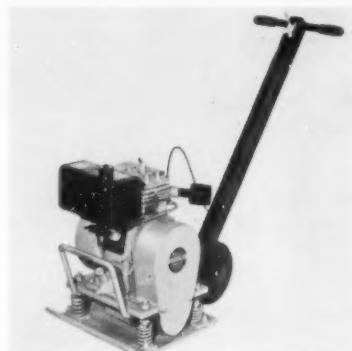
Worthington Announces New Comminutor

The Worthington Corp., has announced that a new 36-in. comminutor has been added to their present line of 15 and 25-inch comminutors. This unit handles flows up to 26 mgd. Powered by a 2-hp gear-motor, the comminutor is equipped with an oscillating cutting arm which travels back and forth across the entire screen 8.7 times per minute. Coarse solids are reduced small enough to pass through the comminutor's screens (which have 3/8 inch slots) without removal from the sewage flow. It is designed to fit into either a new or existing 4-ft. wide straight rectangular channel having a recommended minimum depth of 54 inches. For further information, write to the Public Works Department, Worthington Corp., Harrison, N. J. or circle No. 5-31 on the reply card.



Comminutor is powered by 2 hp motor

Vibratory Compactor Delivers 2-Ton Blows



Weight of the compactor is 210 pounds

A self-contained vibratory compactor announced by Maginniss Power Tool Co., is self-propelled and travels up to 30 ft. per min. It delivers up to 7000 two-ton compacting blows per minute and provides maximum desired compaction in granular soils, stone sub-bases, asphaltic concrete and soil cement. A centrifugal clutch permits the engine to idle without vibrating the compactor, and the engine can be started and warmed-up with the vibrator automatically disengaged. For further details write Maginniss Power Tool Co., 154 Distl Ave., Mansfield, Ohio or circle No. 5-32 on the reply card.

Concrete Pipe For Culverts, Water and Sewer Lines

Cen-Vi-Ro, made by Vulcan Materials Co., is used for storm sewers, highway culverts, high type sanitary sewers, and for pressure water transmission lines. This reinforced concrete pipe is the result of centrifugal compaction, consolidation by vibration and pressurizing with a roller. It assures a permanent water-tight joint by a rubber "O" ring-type gasket easily and quickly placed on the spigot end of the pipe. The pipe comes in convenient laying lengths of 7½, 10 and 12 ft. Diameter sizes range from 12 to 84 inches. For further details write Vulcan Materials Co., 2019 Sixth Ave. N., Birmingham, Ala., or circle No. 5-33 on the reply card.

Salvage Revenue from Refuse

During the fiscal year 1956-57, El Paso, Tex., received from refuse \$7,319.79 for salvage. Of this \$5,383.12 came from tin cans; \$943.18 from rags; \$120.00 from bottles and rubber; \$515.55 from non-ferrous metals; and \$357.94 from cardboard.

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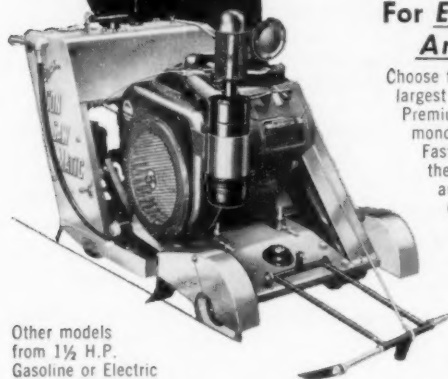
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More and more building contractors specify NEENAH fine quality construction castings FIRST. The Neenah line also includes manhole frames and covers, catch basin inlets and many other items to meet any construction requirement. Write today for your free copy of Catalog "R," second edition: 140 pages with pictures and description.

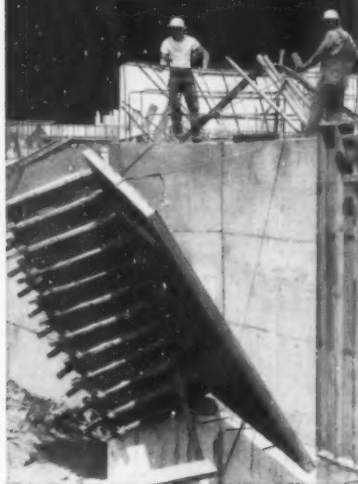
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by Arthur K. Akers

★ **YOU ARE INVITED**, if you are at the A. W. W. A. Convention in Atlantic City in May, to drop in and see us at **PUBLIC WORKS'** new display, booths 417-419. Adequate welcome and resting places will be awaiting you.

★ **A. E. (Ollie) KRAMER** of Springfield, Ill., is now district representative, Shovel Supply Co., Dallas, covering thirteen Central-Midwest states.

★ **VULCAN MATERIALS CO.**, Birmingham, Ala., newest giant in the public works field, has been formed by merger of Birmingham Slag Co. and its subsidiaries in the Southeast and Vulcan Detinning Co., with plants in New Jersey, Pennsylvania, and Indiana. Products include aggregates, slag, hot and cold paving materials, Cen-Vi-Ro pipe and plastics pipe linings.

★ **BARBER-GREENE CO.** announces promotions: W. E. Putz to administrative assistant to E. H. Holt, vice-president and sales director, while Charles E. Parkin succeeds Mr. Putz as advertising manager.

★ **RELIANCE STEEL PRODUCTS CO.** (gratings and bridge floorings), McKeesport, Pa., opens a New York office with John Karboska as its district manager.

★ **AMERICAN BITUMULS and ASPHALT CO.**, San Francisco, names W. K. Smith as district manager, St. Louis. R. P. King replaces him in Mobile.

★ **WILLIAM B. PETERS** is new vice-president and treasurer of J. I. Case Co., tractor manufacturers, Racine, Wis. John D. Grayson becomes controller.

★ **WENDELL GRIER** is new eastern sales representative W-K-M Division ACF Industries, under William A. Gormley at Houston. Mr. Grier's headquarters are in Baltimore.

★ **V. L. GREEDY** is appointed sales manager, Pipe Linings Inc., Wilmington, Calif.

★ **RAYMOND E. BURTON** is the new assistant director of marketing, Koehring Co., Milwaukee.

★ **W. R. MEADOWS Inc.**, Elgin, Ill., promotes Robert G. Stilling to general sales manager. T. Ray Johnson becomes vice-president in charge of sales.

★ **WISCONSIN MOTOR CORP.**, Milwaukee, names F. Burrows Esty, chief engineer, and Ray J. Fellows, sales manager, as vice-presidents.

★ **IT IS** a dull day when Armco Drainage and Metal Products does not announce another new plant; this time a \$400,000 one at Wellington, Ohio—their 54th.

★ **W. E. ROBINSON** again heads the Robinson Clay Product Co., Akron, as president.

★ **GRAVER TANK & MANUFACTURING CO.**, East Chicago, Ind., announces E. N. Gosselin was elected chairman of the board and J. E. Swanson president.

★ **C. E. ANDERSON** becomes sales manager, paving equipment division, The Jaeger Machine Co., Columbus, Ohio.

★ **"LIFELINES FOR CIVILIZATION"** is title of a new documentary film, to be shown first at the A. W. W. A. meeting in Atlantic City May 12-16. Produced for the American Concrete Pressure Pipe Association, it will be available afterward on loan for group showings. Association may be addressed 28 N. La Salle St., Chicago 1.

★ **W. J. WOOLLEY** is promoted to executive vice-president, The Henry Pratt Co., (butterfly valves) Chicago.

★ **TO DRESS** a modern soldier requires the wool from three sheep and the hides from ten taxpayers.
—Link Belt News

PUBLIC WORKS for May, 1957

NEW SIMPLEX ELECTRO-PNEUMATIC SYSTEM PROGRAMS FILTER WASHING AUTOMATICALLY

Fully-interlocked System Regulates Flow; Shuts Down, Washes, Rinses, and Reopens Filters

Now simplicity, efficiency and manpower savings come to filter plants with the new Simplex Automated Filter Operating Table.

From one central point, filtering and washing cycles can be initiated automatically . . . all rates and times maintained accurately. Valve action is completely pneumatic! The system contains no electrical devices that might malfunction in the dampness of a wet pipe gallery.

Shut-off and Cut-off

This new system automatically shuts off a filter if the clearwell is filled—returns it to service when needed. Depending on the control you prefer, a filter will be automatically removed from service for backwashing when (1) loss of head reaches cut-off point you pre-set (usually 8') or (2) electric timer has run through the value you pre-set (80 to 120 hrs.). At any point, the operator can manually over-ride these automatic controls.

No-Flood Washing

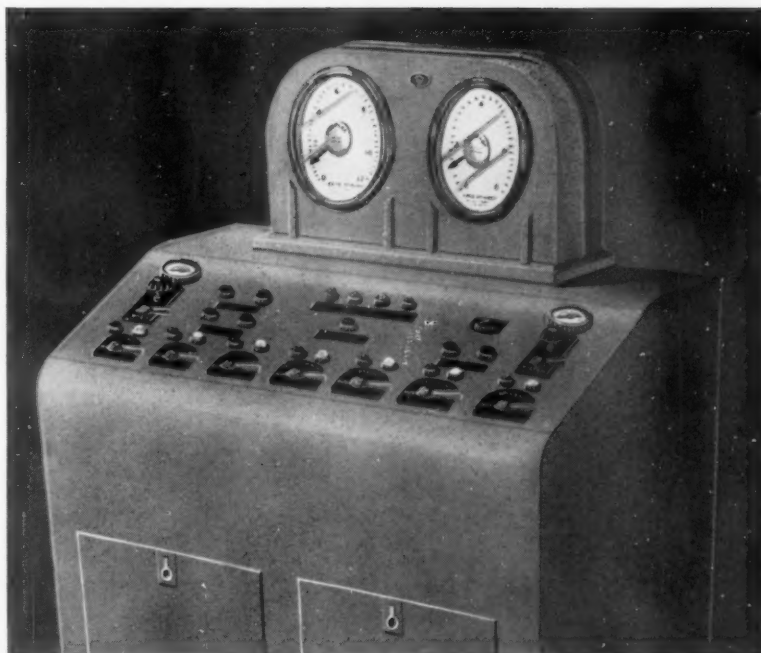
When automatic program starts, the filter Influent Valve is closed, water level drops to wash-trough lips, then the filter Effluent Valve is closed.

Next the Drain Valve is opened, followed by the Wash-Water Valve. Pneumatic interlocks prevent flooding: wash valve can't open until drain valve is fully open.

Washing is precisely timed at slow-fast-slow rates . . . so bed is cleaned and hydraulically graded for clean starts and optimum results.

Saves Treated Water

To prevent flooding, Drain Valve can't close until all Wash Valves have first closed. To prevent waste



NEW SIMPLEX AUTOMATED FILTER TABLE: Large dials indicate and/or record rate of flow and loss of head. Smaller dials set filtration and wash rates. Colored lights show progress of the automatic cycle. Manual levers permit operator to over-ride the automatic programming at any point.

of treated water, filter Influent Valve can't open until drain valve has completely closed. Washing period can be extended, if desired.

Controlled Starts

To prevent turbid starts, when the Influent Valve is opened, the Effluent Valve stays closed until water reaches operating level. Float switch then opens Effluent Valve.

No Sequence Errors

Cascade programming makes mistakes impossible. All valves open and close in their proper sequence.

Automated Filter Plants

Obviously the control functions built into this new Simplex Table can also be used to control a series of filters. We'll gladly discuss your plans for integrated sequential control that interlinks all filters for fully automatic operation of an entire filter plant.

Your Plans

We'll gladly rush further details or a Bulletin to help you evaluate this important Simplex development. Write Simplex Valve & Meter Company, Dept. PW-5, 7 E. Orange Street, Lancaster, Pa.

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VALVE AND METER COMPANY

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with the

W&T

Quality-Quantity Chlorinator

Select the residual you want and the new W&T Quality-Quantity Chlorinator will automatically maintain that residual. Immediate sensing of any change in a water's chlorine demand—as well as flow—automatically controls chlorine feed rate to maintain a desired residual. That is Dosage Automation with the new W&T Quality-Quantity V-notch Chlorinator.

DOSAGE AUTOMATION OFFERS THESE FEATURES

Variable Residual
a selected residual, free or total,
with automatic dosage control.

Flow Sensing
changes in chlorine demand.

Capacity
Chlorine feed up to a full 100 to
1 range at rates to 2000 pounds
of chlorine per 24 hours.

Records
a record of chlorine dosages in
p.p.m. and chlorine feed rates in
pounds per 24 hours.

Variable Orifice
the proven W&T V-notch Vari-
able-Orifice for accurate, wide
range chlorine feed.



*For more information about this new type of
chlorination system write for Bulletin S-116.*



WALLACE & TIERNAN INCORPORATED

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